gemini

Future Mobility in Singapore | TUM Create

Written and Designed by

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„Roads? Where we‘re going, we don‘t need roads.“

- Doctor Emmett Brown, Back to the Future -

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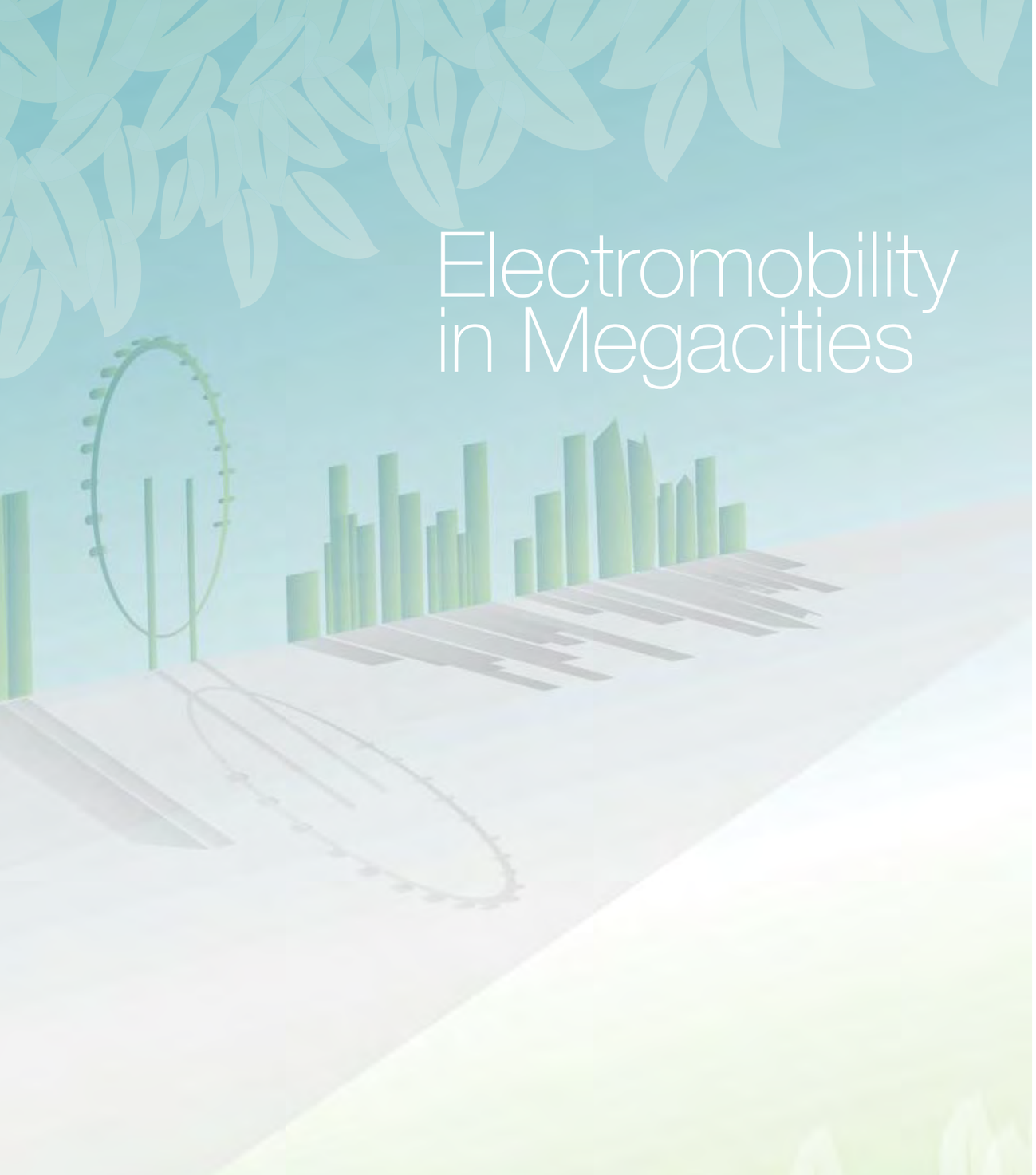
Introduction

TUM Create is a research programme sponsored by the Singaporean National Research Foundation (NRF). It is jointly performed by Technische Universität München (TUM, Munich) and Nanyang Technological University (NTU, Singapore), and it aims at the development of innovative technologies and future transportation concepts matching the challenging requirements of fast growing and continuously changing tropical megacities. A central role is played by electric vehicles and all related technologies, e.g., design, batteries, embedded systems, vehicle technology, and infrastructure. A vivid exchange of students and scientists is actively supported by the programme.[1]



Electromobility in Megacities

About TUM CREATE Research Programme for Electromobility

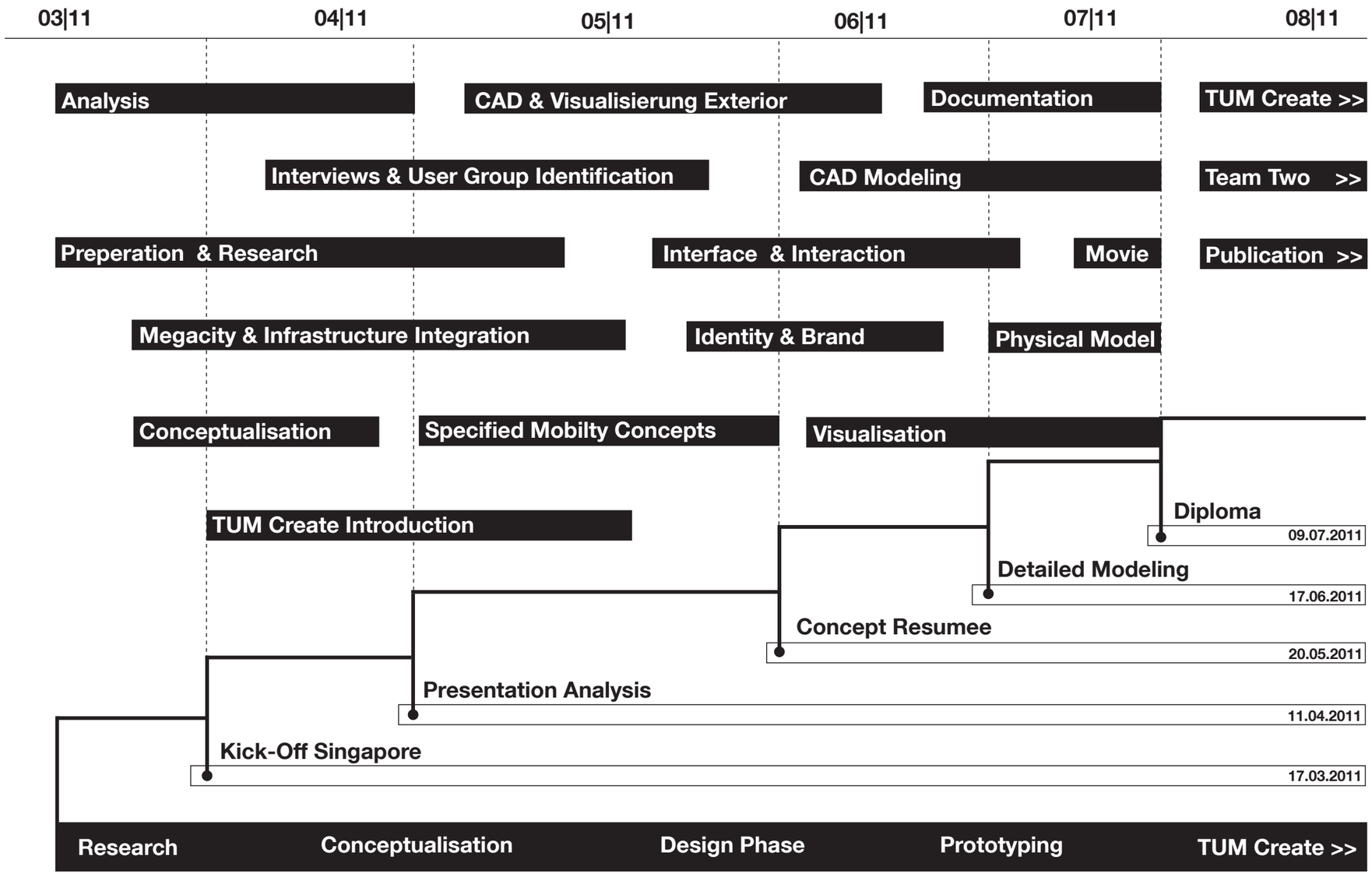
An NRF-NTU-TUM Sponsored Programx

Limited petroleum reserves and uncertainties in their supply due to geo-political reasons have made crude oil a resource too valuable to be primarily used for transportation. Thus, with dramatic increases in the demand for energy related to transportation, concerted technological efforts to provide alternatives for vehicle propulsion are essential. Electric vehicles, with onboard electric energy storage and use of electric power-trains, will reduce the consumption of primary energy and CO2 emissions by 50%. The existing basic infrastructure for distribution of electricity through the existing grid also makes electric vehicles a technology amendable to rapid deployment and adoption. Vehicles have to be fundamentally redesigned and a large number of components have to be significantly reinvented for this kind of propulsion. Furthermore electric energy storage solutions with high energy and power density are necessary, which are not available today. There is immediate demand for research including all phases of the activation of new technology from fundamental research to application. Extensive research and development is being pursued worldwide for the realisation of electric vehicle propulsion. TUM is one of a handful of universities that possesses a long standing know-how and centre of excellence in e-mobility, with several institutes working in this field for up to 20 years. With surging worldwide interest in electric vehicles, in March 2009, TUM initiated the TUM Centre for ElectroMobility and will join forces with Singapore through this proposed CREATE project. TUM is dedicated to set an example of rapid academic and educational transfer to a new environment that is typified by Singapore. This 5 year project will push further the state-of-the-art in e-mobility. Application of world-renowned strategies and methods of project oriented Private-Public-Partnerships will empower educat ion and research in the field of e-mobility in Singapore. Through joint research at NTU and TUM and the collaboration of their research centres and institutes, the TUM-CREATE Centre will strongly emphasise fundamental research to create a broad basis and the foundation for a long-term success of e-mobility and for the sustainability of its technology.

TUM and its Centre for ElectroMobility will provide areas of research that will contribute to an all-integrative and longlasting approach to e-mobility and its success would naturally lead to alternatives to fossil fuel driven vehicles, a concept that may be implemented in Singapore and applicable to most megacities worldwide.

What to Expect After Five Years

The CREATE-Project “E-Mobility in Megacities” will yield a strong benefit for Singapore, i.e. a clearly higher level of expertise and knowhow in electric vehicle and infrastructure technology. The wide and deeply going expertise and know-how gained through this project may also be as well applied to develop other types of electrical vehicles, such as buses, transporters and aerospace applications.



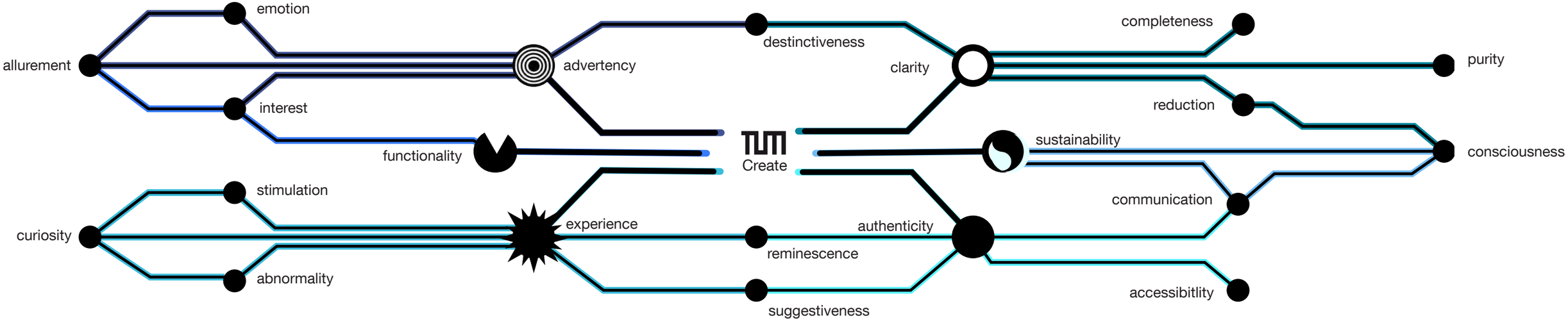
Timetable Design

The timetable clearly shows the organisation and the project partitioning. The only way to realise such a complex task is an exact time management. Important stages of the conceptual design are envisioned. Intention of the diploma is a vision of future mobility in Singapore and megacities.

Mindmap Future Mobility

The subject future mobility can be understood in a variety of distinct contexts. The developement of a thematic mindmap illustrates an abstract approach to early design concepts, which define essential qualities in the field of mobility and infrastructure.

After collecting these contexts, selecting, categorizing and prioritising the various themes plays an important role in finding the final topics and destinctive themes parameters, which later define the main focus in the final design stages.



Singapore Clash

Megapolis is a characterisation that perfectly fits to a city like Singapore. The 5-million metropolitan island is not merely a city - it is a conglomeration of various cultures, attitudes and people in one place of enourmous density. For the future mobility project it is highly important to understand this rich clash of cultures and unbelievable variety of influences forming a very special singularity on the world map. This chapter is trying to communicate the experience of such a megacity.

Opposite | View of the city's financial district from Marina Bay Sands infinty swimming pool set on top of the world's largest public cantilevered platform

Above | Work Holyday Pass : The Work Holiday Programme (WHP) allows foreign university students and recent graduates, between 17 to 30 years old, to come to Singapore to live and work for up to six months.

Previous spread left | The Singapore Merlion symbol was designed by Fraser Brunner, a member of the Souvenir Committee and curator of the Van Kleef Aquarium, for the logo of the Singapore Tourism Board (STB) in use from 26 March 1964 to 1997 and has been its trademarked symbol since 20 July 1966. [11]

Singapore provides us with a one of a kind postmodern reference to the global intermixture of a multiplitcity of cultures. It's multitude of parallel cultures, views and styles blurs the line between a colorful chaotic experience and the stringent interpretation of statutes and laws. Singapore, a secular immigrant country, is evidently tryng to create it's own culture of now, changing faces as you advance with the rapid extension and development of the city and the island itself. The authors' impressions of Singapore were documented by their photographes in this chapter.

Up close, this world reveals itself as a unique microcosmos of marvel. We seem to be visitors fom another world, yet being welcome by the local community, which itself is considered a melting pot of many different cultures and therefore is a reflection of its immigrant history.

Megacity is a characterization that doesn't understate the sheer dimension and density of this urban agglomeration on the island south of the Malayan peninsula. Surpringly leaving the town's centres around City Hall, Orchard or Marina Bay quickly leads into traditional quarters like Little India, Geylang or China Town where a more authentic experience of grown and not government implemented structures can be found. The clash of the many cultures defines the picture of this compact place and gives us a deeper insight to the immigrant's history and the blending of different attitudes into one single nation.

सहिपुर

Singapura | Singapore

The English name of Singapore is derived from its Malay name, Singapura which references to the nation as the „Lion City“.[12]

The country of Singapore is located on 63 islands and lies south of the Johor strait, which together define the southernmost conclusion of the Malayan peninsula. The border to Indonesia is shaped by the cit‘s southern strait. As a result of the limited landfill, reclamation of land plays a decisive role in the cities history and future. The land material is being extruded from it‘s own mountains, the sea bed or adjacent countries like Malysia.

Singapore‘s climate can be compared to those of tropical rainforests with no distinctive seasons, uniform temperature and pressure, high humidity, and abundant rainfall. April and May are the hottest months, with the monsoon season, from November to January. Singapore does not observe summer time although its position much to the west of its time zone acts as a perpetual daylight saving time.[13]

Singapore‘s inhabitants consist of a great cultural mix, therefore racial and religious harmony is regarded by the government as a crucial part of Singapore‘s success and played a part in building a Singaporean identity. Singapore‘s inhabitants consist of a great cultural mix , which is also represented in the many official languages English, Malay, Chinese, Tamil.[14]

Opposite | Cloudy Singapore Skyline photographed from Henderson Waves pedestrian bridge near Mount Faber

市中心

City Centre | Urban Density

The central district area which is defined by Orchard Road, Balestier Raffles Place and Marina Bay is the figurehead of Singapore‘s business, cultural, leisure and urban development. A highly dense and strictly organized infrastructure brings the different quarters together while still trying to provide enough green links and spaces in the heart of the megapolis. In the centre the more and more vertical urbanism, the obliteration of single monumental structures and the vanishing of the indivdual levels and floor plans is utmost evident. The high rise core aims to provide roof garden landscapes, restaurants, shopping opportunities and other experiences far away from the ground level of the streets.

Opposite | Central Business District located around Raffles Place

Below | Marina Bay Sands Hotel from below the Helix Bridge at Esplanade

Left | Sri Mariamman Temple located in the traditional Quarter of Chinatown

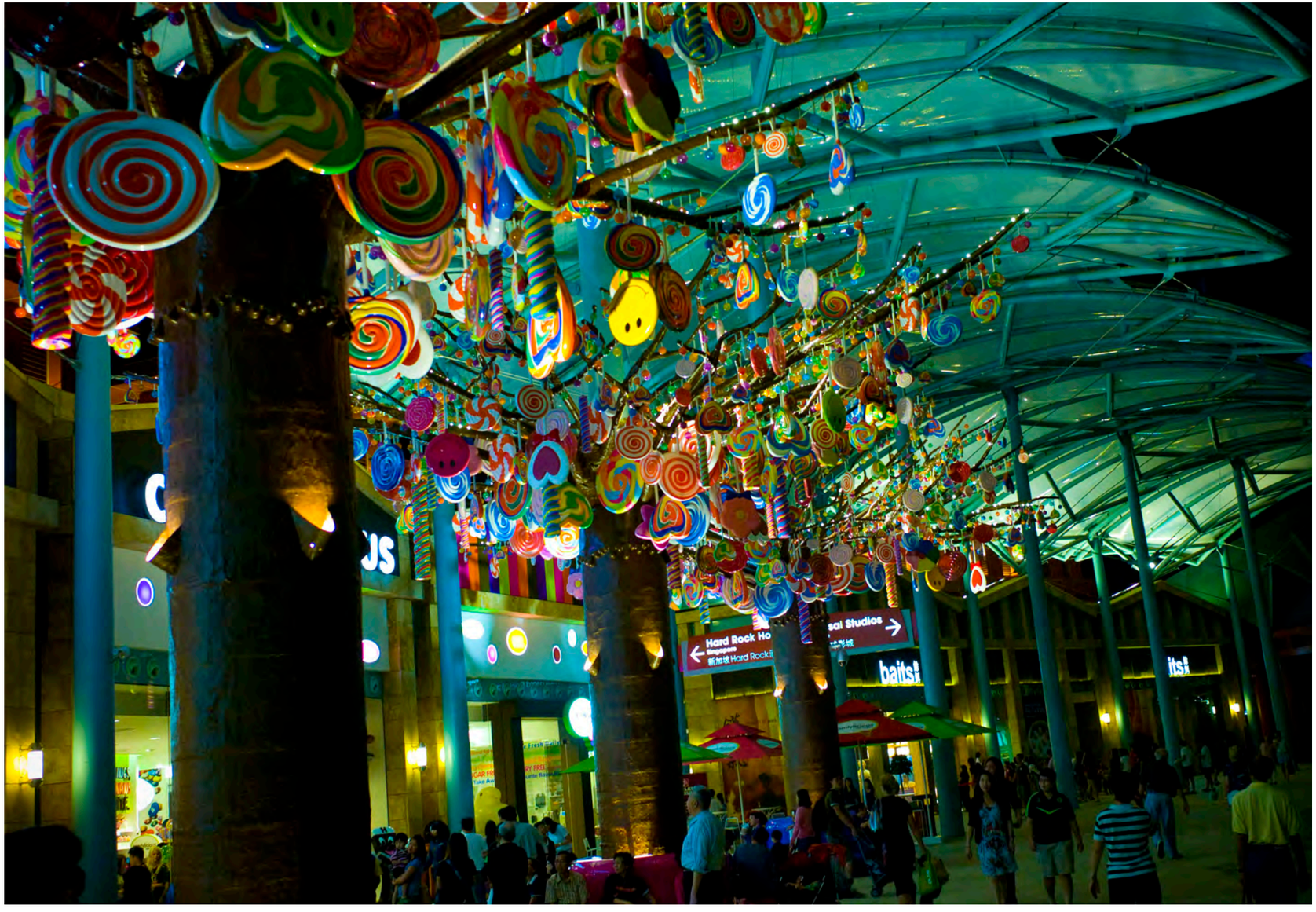
Below | Building in Little India with a traditional color scheme

छोटे भारत

Little India | Traditional Quarter

The street life in Little India offers an intense and vivid contrast to the newly built and strictly conform organized quarters in Singapore. Especially on sunday evenings, when Indian workers from all over the city, are gathering in the small streets of this colourful corner of the city, the place becomes a lively exchange of goods, thoughts and people and therefore creates it‘s own rules and dynamics to become a microcosmos within the boundaries of Singapore.

Opposite | Colorful facade detail



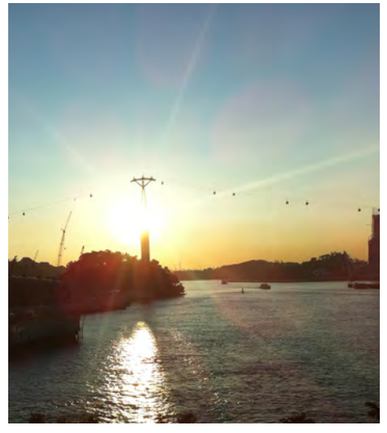
Sentosa

Sentosa Resort | Artificial Leisure Island

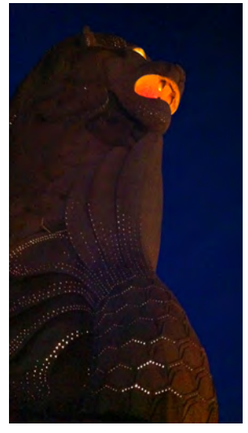
Sentosa Island is an artificial built resort, which was augmented through a reclamation of land from a former British military base. Sentosa was once known as „Pulau Blakang Mati“ which in Malay means the „Island (pulau) of Death (mati) from Behind (blakang)“.[15] In a 1972 contest organised by the Singapore Tourist Promotion Board, the island was renamed Sentosa, a Malay word meaning „peace and tranquillity“. Through the 1980s and 1990s, a number of tourist designations were built on the island, most of which the local people found uninteresting.[16] Consequently, there was a joke that the name Sentosa stood for „So Expensive and Nothing to See Also“. It‘s purpose as a fun island is designed for a variety of leisure activities:It contains the Universal Studios, a beach landscape, a Segway parcour, a casino and many more.

Opposite | Candy trees photographed in the Sentosa shopping mall

Below left | The Cable car is just one way to enter the resort (besides monorail, ferry and a pedestrian bridge equipped with escalators)



Below right | Situated in the island's centre is a 37metre high statue of the Merlion, Singapore's mascot. The Merlion symbol was designed by Fraser Brunner, a member of the Souvenir Committee. [17]



Opposite | The colourful facade of Rochor Centre tries to obliterate the monotony of it's architecture

Below right | The figurehead of the House Development Board: Pinnacle @ Duxton

Below left row | People's Park: One of the original preserved HDBs

建屋发展局

Housing and Development Board | HDB

After gaining self-governance, Singapore was facing serious ploblems in housing shortage. The housing and Development Act was passed in 1960 which introduced the Housing and Development Board. The Home Ownership for the People Scheme helped Singaporeans to buy their flat instead of renting it, acted as a hetch against inflation and provided financial security to home owners. 54,430 HDB units have been built between 1960 and 1965. The typology of the flat was chosen due to land constraints, high-rise and high density on the main island. HDB policies were set out in a manifesto by the government, which was promoting social cohesion and patriotism within the country. A quota to prevent secretarianism was introduced in 1980.[18] No particular racial groups were allowed to concentrate together. Thus housing of different income groups were mixed together to prevent social stratification. Public housing precincts form clusters of public housing blocks arranged as a collectively grouped single unit.

購物 & 餐飲

Shopping | Dining

Opposite | Suntec Food Court

Below left | Public food in Chinatown and Lucky Plaza shopping mall on Orchard Road

Below left | Book shop in Little India

With hundreds of interconnected shopping malls throughout the island, all with their various integrated food courts (often referred as „Food Republic“) provide an excessive supply of goods, food and services which meet the exceeding willingness of Singaporeans and the many tourists. From the huge flagship stores on Orchard Road to the small retailers, they all share an enourmous range of products, add-ons and variations to fulfill the people‘s obsession with consumerism and their needs to express their individual character. Even the HDBs and every Museum in town provide at least some restaurants and shopping opportunities. The interlinked malls, which you can reach without seeing sunlight, equal a ginant underground and the same time sky-high themepark where the lines of levels heights and storeys blur.

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Religious Life | Building Communities

Singapore is a secular immigrant country. The main religions in Singapore are Buddhism, Christianity and Islam. With Singapore being a melting pot of such a variety of nations, all with their own backround history and personal beliefs, it will always have to handle several attitudes and views of life to form an own identity. In this megapolis the many religions compete with each other actively and try to build up and enlarge their own communities to gain more political and social influence. On the other hand all the many different religions co-exist in this densely populated island in harmony and respect for each other.

Above middle | A crowded sunday evening at Sri Veeramakaliamman Temple in Little India

Above right | Contemporary Marketing for the Christian church and St. Andrews Cathedral

Below | St. Andrews Cathedral located on a green space near City Hall in the crowded city centre

Opposite | Hindu Street Shrine fittet into the Sim Lim Tower building services near Little India

ゲーム

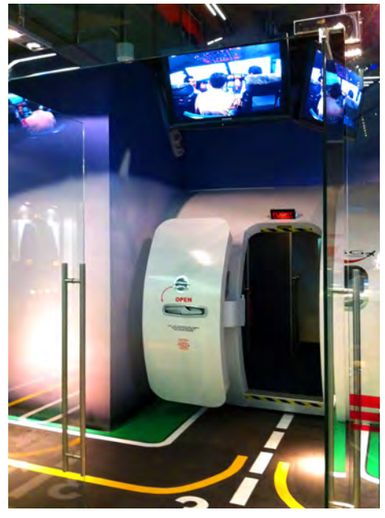
Game | Entertainment

After decades of thore thumbs, simple button-pressing is finally getting out of fashion. Entertainment and Video gaming is closely connected to Singapore‘s daily life. From the arcades in the countless shopping malls to the downloadable smart phone games played by a multitude of Singaporeans in the MRT. Orchard Road is a perfect example for the electronic overkill provided in the island‘s high density areas. Nearly every shopping mall along Singapore‘s Fith Avenue is equipped with building high Media Facades that bombards trespassers, which mostly comprise of tourists, with endless advertisements and sales promotions.

Opposite | Star Factory arcade at Suntec City mall

Below centre | Indoor Flight Simulator in Orchard Central shopping mall

Below right | Media Facade Orchard Central shopping mall



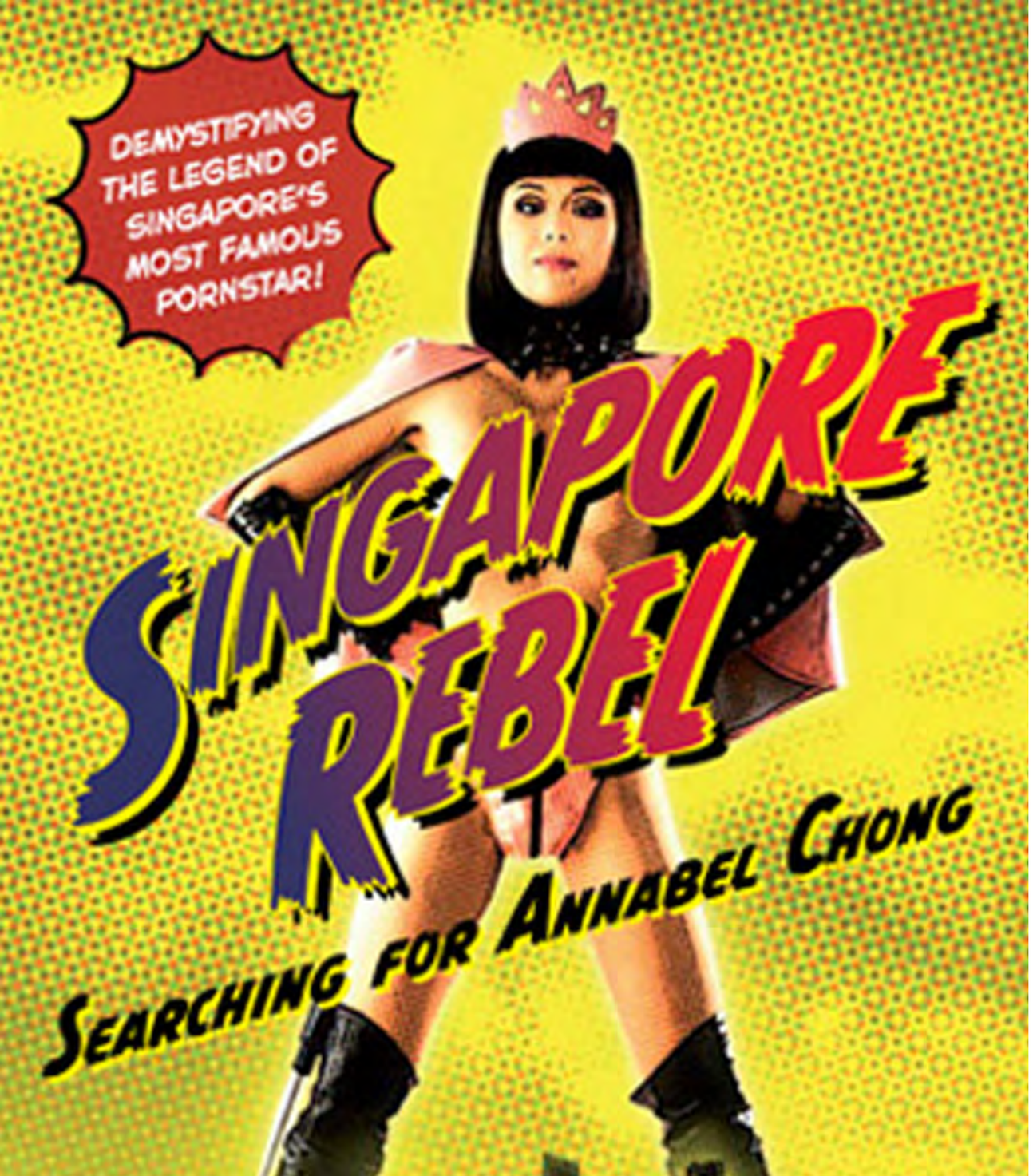
Opposite | Elmgreen & Dragsets art performance at Biennale 2011

Below centre | Thieve's market

Below left | Hostess at Orchard Road, Malayan workers, Haw Par Villa - 10 courts of hell

文化 संघर्ष
Culture Clash

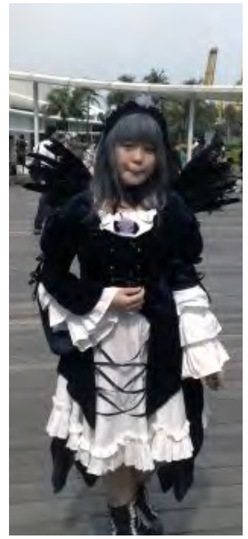
The melting pot of Chinese, Malay, Indian and British people forms the current identitz of Singapore. This agglomeration of several peolpes forms a mixture of it's immigrants histories and creates an own dynamic. This is reflected in the island's clash of cuisine, ethnics, religion, language (Singlish is an Enlish based creole language) and arts. Singapore maintains tight restrictions on art and cultural performances. [20] Most artistic works have to be vetted by the government in advance, and topics that breach so-called out of bounds markers are not permitted. While the markers are not publicly defined, they are generally assumed to include sensitive topics such as race, religion, and allegations of corruption or nepotism in government. Harmony, appreciation and respect with ather people and cultures play an highly important role in the Sigaporean eduction.



身份

Developing Identity | Emerging Subcultures

With the increasing wealth of Singapore‘s population, the city‘s inhabitants start to question the government authority. A new generation of creative thinkers arise in the island state, which is less influenced by Western archetypes, ideals and moral concepts than the generations before them. This young generation establishes new cultural roots and will probably be responsible for a rethinking of Singapore‘s current social concepts regarding housing, infrastructure, fashion, politics, gender roles, community, education, government control and religion.



Opposite | The book „Singapore Rebel“ gives a controversial view on the city‘s subculture by the perspective of Singapore‘s most famous porn star

Above middle | Vendors at a vernissage by Singaporean fashion label Depression

Above right | Cosplay in public spaces photographed at Vivo City mall

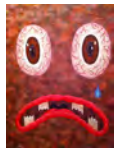
Below | Blurring gender roles at a cosplay convention



可愛さ

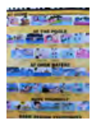
Kawaisa | Icons and Idols

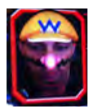
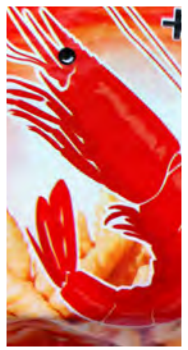
There's a frequent use of iconography in all circumstances of the Singaporean life. This Asian trend derives from Japan, where since the 1970s Kawaisa or cuteness has become a prominent aspect of Japanese popular culture, entertainment, clothing, food, toys, personal appearance, behavior, and mannerisms. The term kawaii has taken on the secondary meanings of „cool", „groovy", „acceptable", „desirable", „charming" and „non-threatening". [21] Contrariwise the island's inhabitants show a huge fascination for transformation, robotics, manga, anime and playfulness.

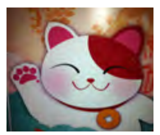



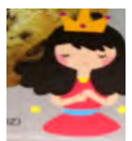


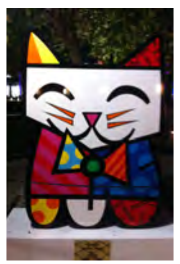




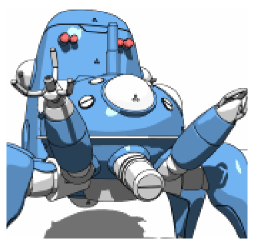
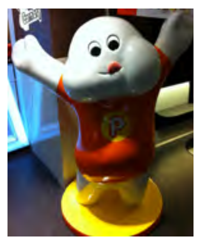










Opposite | Pool Instructions presented as Mangas at NTU

Below | CCTV at Kallang MRT Station and Prohibition Signs at Raffles Places MRT Station

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Signes and Fines | Education

Omnipresent Do‘s and Dont‘s are mostly executed in a comic format or easy to understand iconography. Singaporeans are practically trained social harmony and behaviour in nearly all circumstances.

E|R|P

Electronic Road Pricing

Electronic Road Pricing (ERP) is an electronic system based on a pay-as-you-use principle. It is designed to be a fair system as motorists are charged when they use the road during peak hours.

The Singaporean government uses the system in combination with car licencing and COE (Certificate of Entitlement) to control the amount of cars on the island and in the dense areas of the city. Cars and taxis contain built in units equipped with GPS to bill the trespassers fees depending on daytime and peak hours. Stolen cars can be quickly located because of the built in GPS, while the Land Transport Authority keeps is able to keep track of the town's traffic, but also every individual car with such a unit. Taxi drivers pay approximaltely 300-500$ a week. [22]

Opposite | ERP gantr near Orchard Roady

Below | Electronic road pricing reader in a Singapore taxi

Opposite | David Coulthard shows off in a Formula One car at Red Bull Speed Street 2011 event on Orchard Road

ドライブ

Drive | Demand for Speed and Slowness

Owning one of the Formula One Grand Prix City Circuits, where the only night race of the season is happening, it‘s obvious that there‘s a great fascination for speed among Singaporeans. On the other hand the city is a model region for the Mitsubishi i-Miev and the Daimler hydrogen vehicle Necar. Electric vehicles get subsidized by the government to cultivate electromobility. The NTU competes in the Shell Eco Marathon with it‘s one litre gas vehicle. Contrary to the island‘s need for speed is a high demand for slowness and relaxation to relish family and friends and escape the hectic and sometimes chaotic life in the city‘s crowded core areas. Leisure areas and nature reserves like the island Pulau Ubin in the north east of Singapore shall guarantee a relaxed and harmonic excursion.

Below centre | Display of the NTU one litre vehicle for the Shell Eco Marathon

Below left | Working break in a modified Rickshaw

Top left | Custumized Porsche 911 Carrera Cabriolet

Middle left | Windshield display with soft toys of Domo-kun

Below | Dashboard modiefied with religious symbols and miniature shrines

定制

Product Customization | Zhng Car

Enormous costs for licence, tax and COE make owning a car in Singapore an expensive affair. On the island exits nearly no vehicle, which is in it‘s original condition. The high expenses make owning an automobile a precious good. For this there is a constant need for vehicle owners to individualize their car as much as possible. The exterior becomes an expression of personal likes, taste and mental attitude while the interior, most notably the dashboard functions like a display for personal items and believes and gives an insight into the mind of the automobiles‘s owner.

Opposite | Licenced replica of the Tiger Car owned by Mr. Aw Boon Haw at Haw Par Villa

出租車

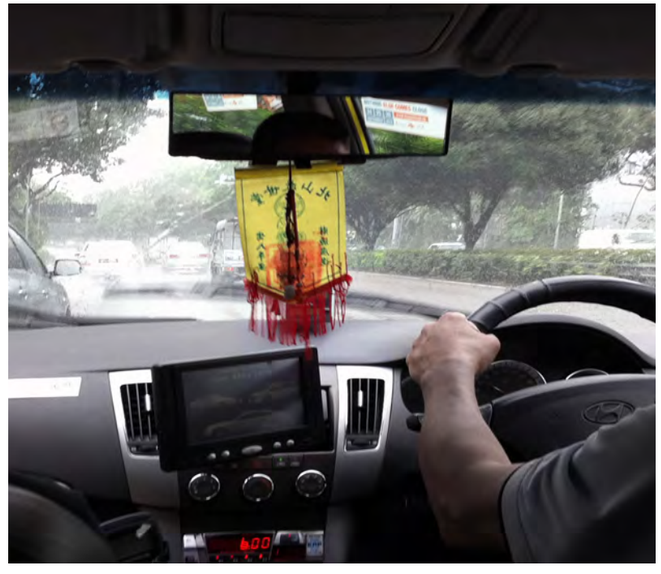
Taxi

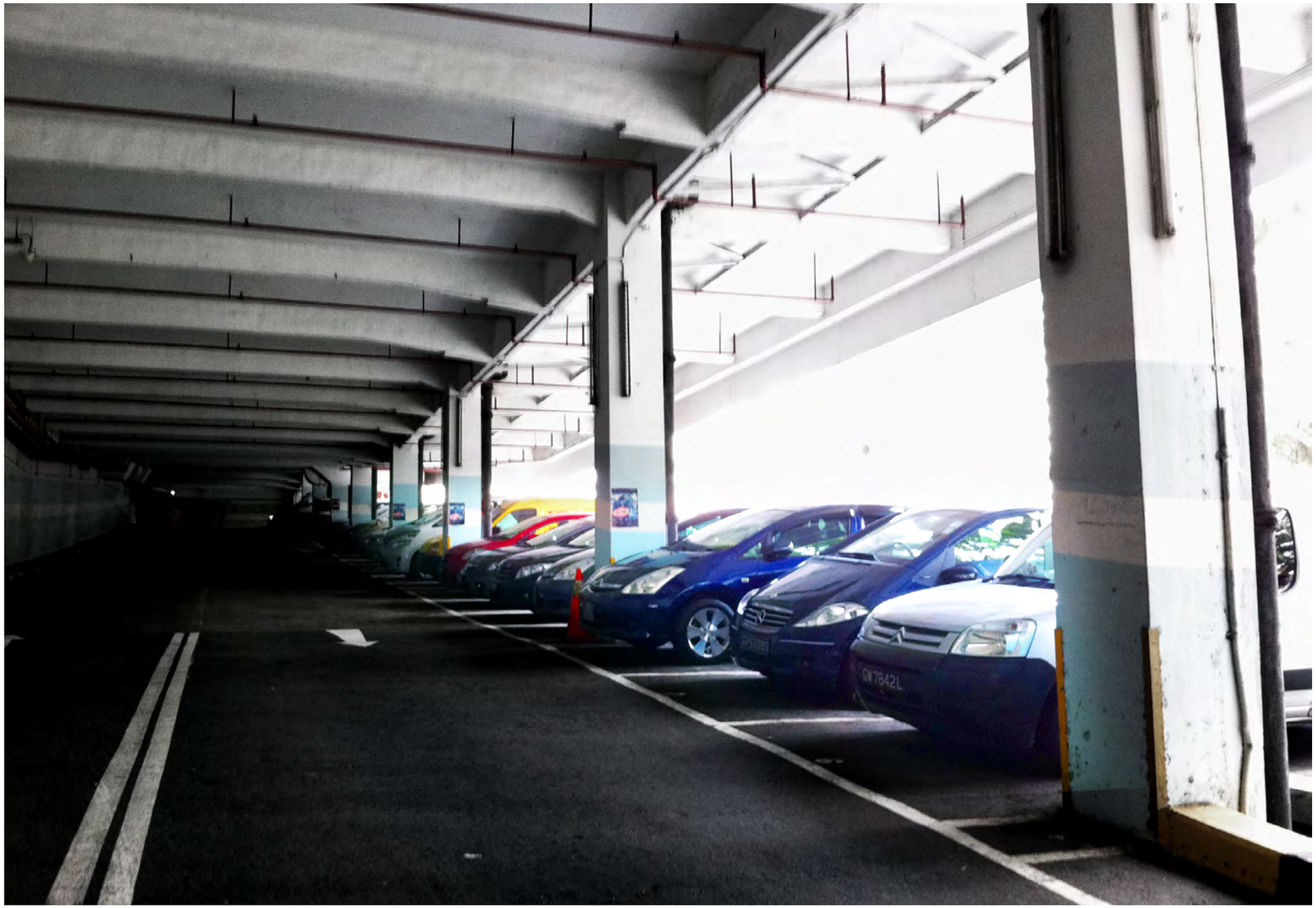
Cabs are a popular form of public transport in the compact city state of Singapore, with relatively low fares compared to those in most cities in developed countries. There are eight major taxi companies, besides special categories like river taxi or rickshaws. The taxis have integrated plug-in units to charge the Electronic Road Pricing (ERP). The fares are dependent on the time of the day. Peak hours are from Monday to Friday 0700 - 0930 and Monday to Saturday 1700 - 2000. For financing the exterior of the cars often becomes a space for creative advertising while the interior often shelters the driver‘s personal goods.

Opposite | Creative marketing on taxi exteriors

Below centre | Cab interior with religious items and talismans

Below right | River Taxi and Singapore Express Rikshaw





停車

Parking

Singapore‘s infrastructure provides more than enough parking space for it‘s inhabitants. Every HDBs has a often multi-storey parking lots well as nearly every shopping mall and office building throughout the town. Similar to Tokyo reverse parking is the common practice in Singapore, but unlike in Japan where this kind of parking is performed due to fast means of escape in case of an earthquake, Singapore‘s parking space is just calculated to a minimum space which makes it difficult to get the vehicle out of a parking space, if it‘s not parked in reverse. This parking style in rticular is well trained in Singapore‘s driving schools an shows the people‘s respect for each other.

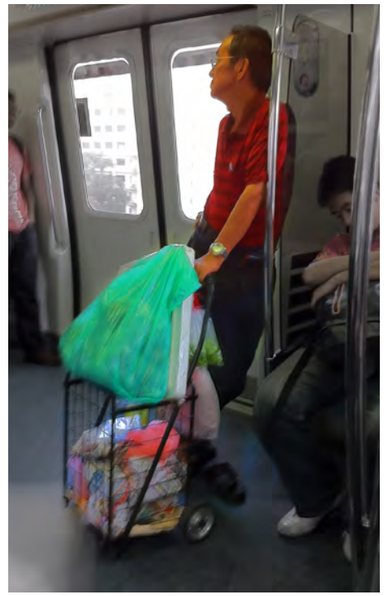
Opposite | People‘s Park HDB integrated seven storey parking lot

Below | The narrow layout of the Mitsubishi i-Miev relieves parking the city‘s narrow lots

نتوكغڠڤ

Transportation Singularities

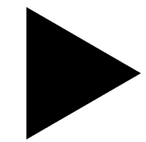
For people of Western origin the many ways of transportation in Singapore may seem a bit inconvenient and sometimes even unorganized. The first thing you notice are the small and manoeuvrable buses that transport up to fifteen Malay workers to the city‘s construction sites. Many inhabitants use modified Rikshaws or Scooters to transport the sometimes not so small goods to their destination while bigger shoppings like furniture are often retrieved by taxi. A very popular way to do the weekly or daily shoppings in the various malls are, often do it yourself assembled, trolleys and caddies.



Opposite | A customized Rikshaw to fit a flatscreen TV driving through Geylang

Above | Man with a modiefied trolley in the East West MRT Line

Below | „Phantoms in the Dust“ (2009) by Eileen Anastasia Reynolds (Assistant Professor for digital animation at NTU ADM) depicting a truck with Malay workers



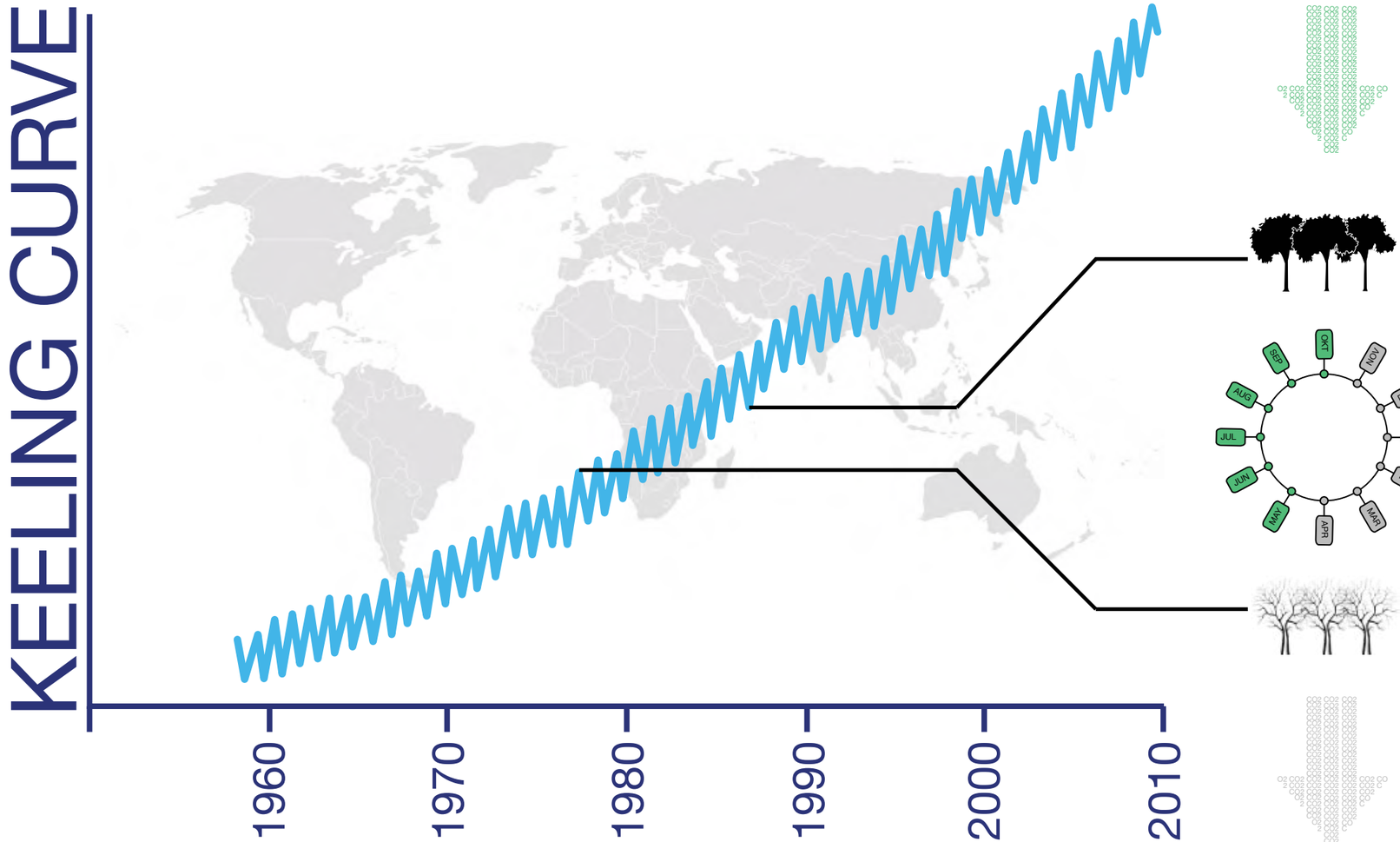
ElectromobilityTrend

The design team was part of the TUM Create cluster C - Research Project 04 (RP 04), which is assigned with Interdisciplinary Development of Vehicle Concepts. The borders between the various domains natural sciences, mechanics ,electrics and computational science fade progressively, especially in the field of electromobility. Thus, creating a standard, procedural and conceptional method to combine all the domains, is a way to reduce complexity, increase flexibility and guarantee a futureproof, as well as transferable approach to other applications.[2]

Climate Change

Opposite I The Keeling Curve as an Indicator of the increasing CO2 content in the Earth's atmosphere

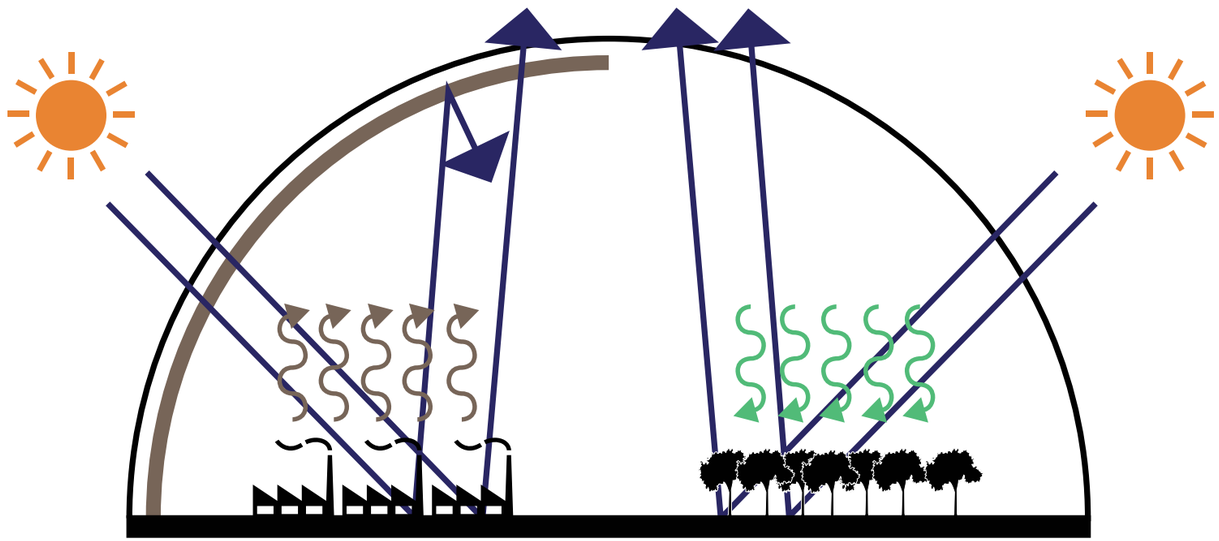
In 1959 for the first time in history the values of the CO_2 content in the atmosphere of the earth were published in a diagram. Since then the data is entered annually and the so-called Keeling Curve came up, the most important chart in modern Science. It is shown in a formidable way how our planet is breathing. From May until October the values are dropping, as plants are growing and gathering carbon dioxide, while in the winter months from November until April the data is increasing, because annual plants are dying and trees are losing their leaves. This explains the zigzag curve in the diagram, but at the same time it becomes clear, that the CO_2 content in the atmosphere in increasing yearly, because the previous year's data is exceeded every time. As early as 1960 the danger was recognized, but only 19 years later, in 1979, a program to examine the increasing CO_2 content in the Earth's atmosphere in more detail was determined, which was based on the Keeling Curve. Not only data from the air give proof to the world's population about the dramatic increase of greenhouse gases during the last decades, but also glaciers bores have ensured, that only since the 18th century industrialization the carbon dioxide content in the world's atmosphere has risen and never fell ever since.[3]



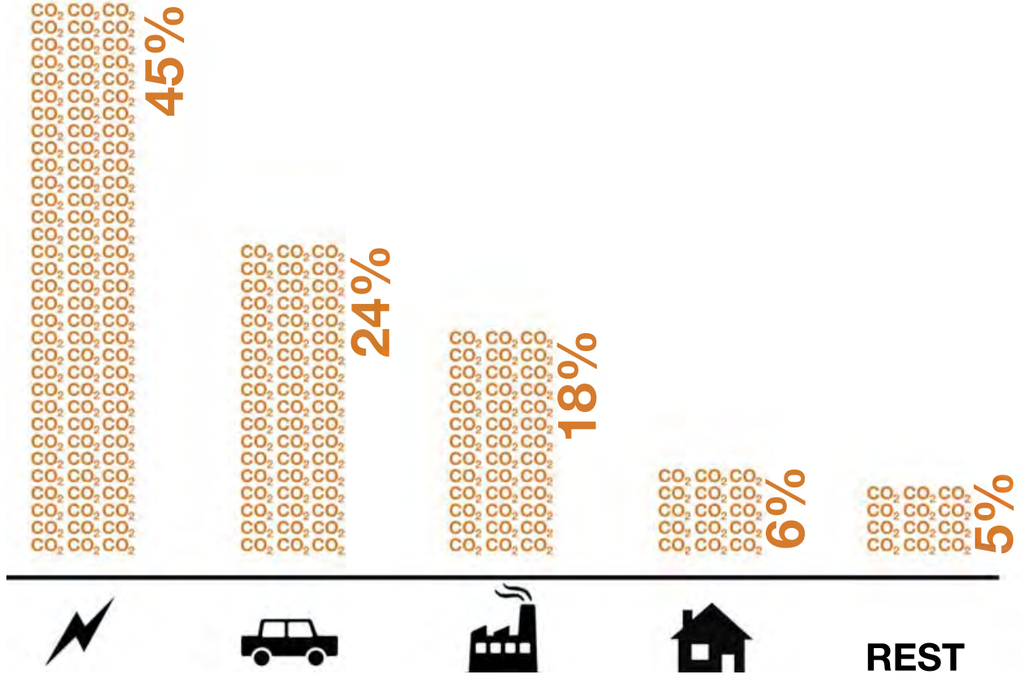
The Greenhouse Effect

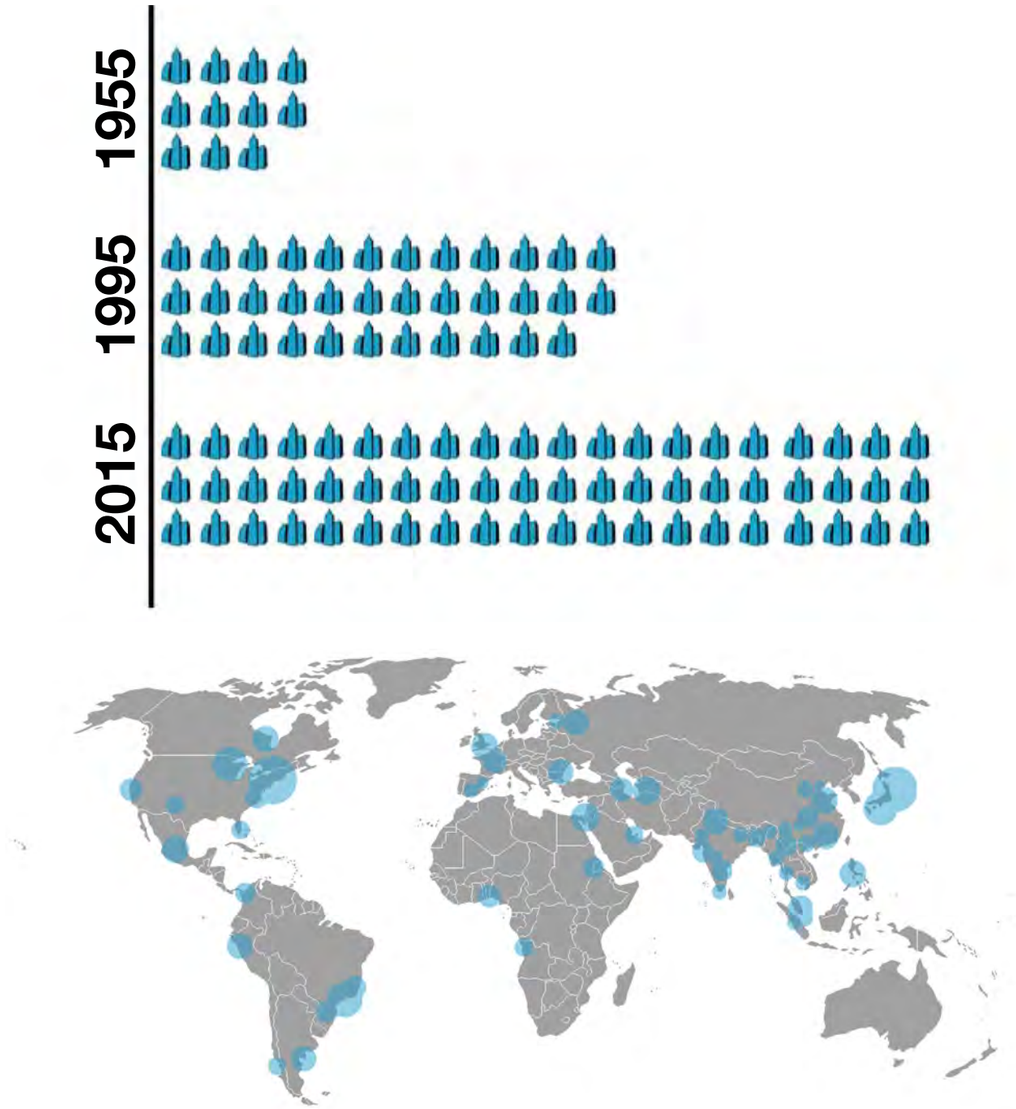
Experts call this the so-called „Global Warming“ and describe the fact, that it‘s getting warmer and warmer on our planet. In the past 100 years the global air temperature has already risen by 0.74 degrees Celsius and the average surface temperature of the oceans has increased by 0.6 degrees Celsius over the last 50 years. The CO_2 emissions are a natural and vital process, but only because of the intervention of humans, the reflection of the reflected heat form the earth into outer space was affected and as a reason the greenhouse effect accrued. The largest share of it are the additional carbon dioxide emissions, caused by the humans. More than two-thirds, about 63 percent come from the fields of energy and the industrial sector. Transport is involved with about 24 percent. Ultimately, in 2007 about 38 percent more carbon dioxide were emitted into the atmosphere than in 1990. If this trend continues, we will the reach a two and a half times higher value of the current one by the year 2030. The consequences of such a development would be devastating for people and nature. The average temperature depending on the region would increase from 1.1 to 6.4 degrees Celsius, thereby jeopardizing the livelihoods of millions of people and wiping out a third if all animal and plant species. The temperature increase would also raise sea levels by several meters, due to the melting of the polar caps. The simple and trivial solution of countless environmental experts will therefore be to convert fossil fuels into energy as little as possible to reduce the extra CO_2 emissions. To master the situation the heads of state and government to agree on the two-degree-target at the World Climate Conference in Copenhagen in 2009. Thus, the temperature rise isn‘t stoppable within the coming years, but by 2050 the average global temperature must not exceed 2.4 degrees Celsius. This means that global emissions of greenhouse gases must be reduced by the middle of the 21 Century to half of the value of 1990.[4] In addition to this objective the planet‘s resources should be protected to ensure future energy. Nowadays humanity consumes in one year as much oil and natural gas as it has been formed in about a million years. Already in nearly ten years, the maximum of world oil production will be achieved. Today the world‘s population feels the decline in reserves, because of daily changing price for petrol at gas-stations.

Below I Global Warming as an effect of industrialization



Below I Human caused carbon dioxide emissions





Opposite above I Comparison of Mega Cities since 1955

Opposite below I Mega Cities in 2030

Future forecasts and scenarios

For these reasons, more and more forecasts are made on possible future scenarios. However, most agree, that by the year 2030 the world population will need 40 percent more energy than in 2007. The fact, that humanity will increase from current 6.8 billion to nearly 9.1 billion within the next 20 years, the energy consumption will raise as well automatically. Even faster the number of cars will grow to say about five times as fast. Thus, there will be driving nearly 2 billion vehicles on our roads in 2050. The largest increase, experts see in China, India and other emerging and developing countries. In such modernizing societies individual mobility plays always an important role, because the car inspires not only growth and prosperity, but also means a gain in personal freedom to many people. In other words, the success story of the car will continue uninterrupted, even in times of climate change. The automobile industry has to face these criteria today. Currently there are 30 so-called „mega cities“ worldwide, i.e cities with more than five million inhabitants. It is expected that this trend of urbanization will continue. As early as 2050 half of the world‘s population will live in cities. This will not only impact on the housing space, but also on the mobility of the population. It raises the question of whether driving will still be possible and if so, what cars will bring the greatest benefit. In addition to the economic aspect the environment comes to the fore more and more. Twelve cylinder sedans or powerful SUVs are probably less useful, because there stuck in traffic jams most of the time. For example, calculations show that drivers in the mega city of Bangkok move around with only 15km/h during rush hour. In Mexico City more than four million cars every day wear for 80 percent of the total nitrogen oxide content of the air. The automotive industry relies on energy efficiency in the past few years.[5] The largest CO2 savings should be achieved on the one hand with a prudent driving style and on the other hand with new drive concepts. Furthermore the environmental awareness will change more and more, so that they want to make an active contribution to climate protection. According to the International Energy Agency there will be a „spectacular turnaround“ in the car trade within the next few years. Innovative developments, such as for example the hybrid, the plug-in hybrid or the electric car, will be preferred when buying a car. All of them should take 60 percent of the market, but most of all the electric car has great potential in the future for the use in mega cities. It‘s quiet and suitable for short distance routes in the city. Nowadays German car drivers are driving less than 80km every day, a route that would be feasible on a single battery charge. In addition the great goal of environmental and climate protectors could be reached. Namely, a car with „ZE“ rating, or „zero emission“.

A new awareness

The federal government intends to create a change in mind of an entire nation in the foreseeable future to a new mobility mentality and to reduce polluting greenhouse gases. According to that one million electric cars will be on the road in Germany by 2020 and about five million in 2030. The EU-Kommission is planing a step further. In December 2010 an official proposal for collaborative action in the EU was written down in the so-called White Papers, which states that from 2050 just electric vehicles are allowed to drive in all major city centers within the EU. In this case the reduction of cars with a conventional engine should happen gradually, so that by 2030 only every second car in a European city is not an electric vehicle. [6] This time period is motivated by the fact that car manufactures still need time to develop corresponding vehicle and mobility concepts and expand technically as far as possible, that cars with an internal combustion engine come into oblivion. In light of those desirable plans of the EU, reducing the emission of greenhouse gases, environmentalists would see a positive future. However, it is not so. Greenpeace calls in view of the promised environmental effect even of a „deception of the public“. From a new study on carbon dioxide emissions proofs that electric-powered cars get worse results in terms of CO_2 emissions than similar conventional vehicles. In the first moment it sounds paradox, but electric cars are actually environmentally beneficial, if the electricity that is needed for operation comes from renewable energy sources.

Opposite I Mitsubishi iMiev production has started in 2010

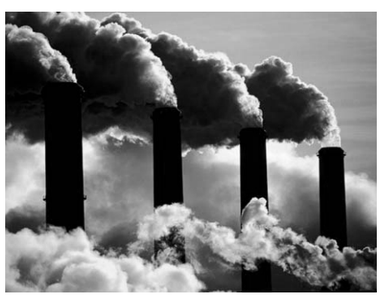
Energy for electric cars

Similar results have been shown in an ADAC test, which has studied not only the energy balance, but also the pollution balance, regarding the new e-Smart driving on German roads. The new electric version of the Smart fortwo is fitted with the usual energy mix of Germany. The amount of CO_2 emissions is 71 grams per kilometer. However, if only electricity from coal power plants is used this figure increases to about 107 grams per kilometer and therefore it is surpassing the same Smart with a diesel engine (86g/km). For this reason the electricity from coal power plants has to be counted, according to ADAC and especially in respect with countries which generate over 75 percent of their total energy out of stone and brown coal mining companies. Actually it‘s deceptively simple, because when he overall electricity demand increases such power stations are always ramped up and therefore more greenhouse gases are produced. One day when so many electric cars, the EU Commission intends to exist, require electricity at the same time, the share of the dirty coal electricity in the energy mix will increase during peak hours. [7] This additional energy requirement for electric cars will continue in the foreseeable future and will only be covered by coal power plants. Only in the distant future there will be low CO_2 power plants with similar performance, which will feed enough electricity in the grid to get a greener energy mix. At this a special focus has to be put on those countries in the Asian region, which are predestined for the electric vehicles market according to automotive manufactures, as they were already mentioned. In countries like Singapore where the power consumption is increasing constantly since the last years because of the enormous use of multimedia facades and entertainment products. These countries are seen role models for electric mobility, but most of the electric cars have to be charged over night, due to a very short range. It‘s hard to imagine the environment will recover, as power plants are blowing twice as much CO_2 gases into the atmosphere than at times without electric vehicles. As a conclusion should be mentioned that the environmental balance of today‘s electric cars isn‘t as good as politicians and car companies like to promise, because electric powered vehicles aren‘t tapping „green“ electricity. Only the claim is true that electric vehicles don‘t produce any pollution in the streets. Therefore the ecological qualities of electric vehicles have to be evaluated holistically, according to the „Well-To-Wheel“ principle. At this the total energy demand is shown from the source to the wheel and as a result it gets clear that just a small amount of the energy gained is converted to kinetic energy. Most of it fizzles and escapes as carbon dioxide in the atmosphere.

Below I Massive energy consumption , Ion Orchard Singapore

Energy for electric cars

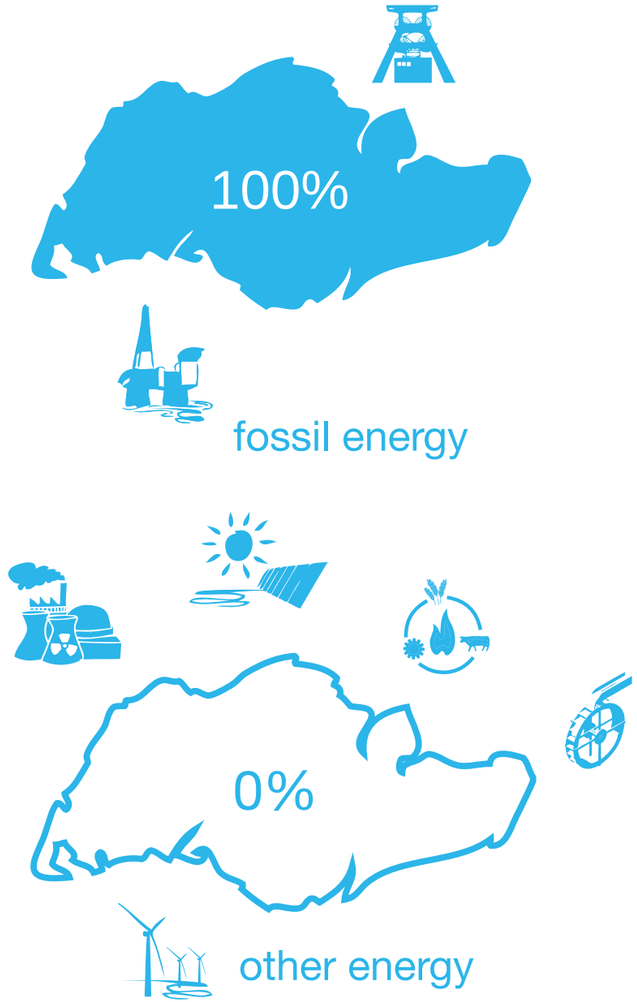
In this day and age this is not the case, due to the so-called electricity mix. In Germany, about 15 percent of electricity are produced from renewable energy sources such as solar, wind or biomass. In no other country in the world so many solar systems generate electricity like in this country. However, the good old coal still is an absolute number one in terms of power generating. About 43 percent and thus approximately half of the total energy production comes from coal power plants. The recently much discredited nuclear energy follows in second place with amost 23 percent and in third place natural gas is found with about 13 percent of the total electricity.[8] This balance is very bleak for the automotive manufacturer's most important market, Asia. Since the more important countries, considering car sales, as China, Japan, Korea and Singapore generate their electricity by fossil fuels, especially in Singapore this value is as high as 100 percent, the percentage of CO_2 emissions of an electric car is whopping 181 grams per kilometer. That is about twelve percent more than in a modern vehicle with a combustion engine.



Opposite I Singapore's Energy production and consumption in 2009

Below I Chimney's of an combined heat and power station

Energy Production (electricity)



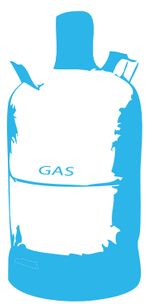
Energy Consumption 2009

Oil

production: 10,910 bbl/day (2009 est.)
consumption: 927,000 bbl/day (2009 est.)
export: 1.374 million bbl/day (2007 est.)
imports: 1.195 million bbl/day (2007 est.)

Electricity per year

production: 39.21 billion kWh (2008 est.)
consumption: 37.11 billion kWh (2008 est.)
exports: 0 kWh (2009 est.)
imports: 8.341 billion cu m (2009 est.)



Natural gas per year

consumption: 8341 billions cu m
production: 0 cu m (2009 est.)
exports: 0 cu m (2009 est.)
imports: 8.341 billion cu m (2009 est.)

Source: http://tinyurl.com/cia-factbook-sn

Above I mia electric car

Energy for electric cars

However, even today there are pioneers in the world of electric vehicles that truly achieve green concepts. In particular, one‘s attention should be focused on the „mia“, an electric vehicle scheduled beginning of 2012 designed by former Volkswagen chief designer Murat Günak. Behind the mia lies not only a conventional electric car, but rather a total approach, because it‘s coupled to absolutely green power concepts. For every sold mia model the company „mia electric“ reinvests in wind farms and solar plants to develop new power generation capabilities that meet the average annual electricity consumption of the electric car. Furthermore the cars are sold as mia-solar and mia-wind and corresponding green electricity tariffs coupled to the budget of the customers, so that every mia driver, who charges his car at the domestic outlet can be sure that the consumed driving energy is completely free of emissions. Indeed this micro car concept is environmentally friendly, but also this electric vehicle suffers because of its lithium-ion battery according to the Heidelberg Institute of Energy and Environmental Research. During production phase of the batteries the CO_2 emissions are exorbitant high and even in daily usage harmful gases for the environment arise, because of daily charging, due to low range performance. To master the increased energy demand power stations must be powered up. It is the range and the possibility of simple and fast charging, at best without any bigger modifications and therefore chargeable at any domestic outlet, are the main criteria for potential buyers, but also the reason why electric cars even in the near future won‘t have any chance to replace conventional cars, because it‘ll still take a lot of time to reach those goals. These are the results of the Deloitte report: „A new era. Accelerating toward 2020. An automotive industry transformed.“ However, it shows that most respondents aren‘t averse of spending more money for an electric car than for a similar vehicle with an internal combustion engine, but only if the price of gasoline exceeds the magical barrier of two Euros per liter. The report also shows clearly that only 16 percent of the respondents could imagine to buy an electric vehicle , but almost everyone in this groups comes from the lifestyle oriented „Generation Y“, which corresponds to the age group from 18 to 34 years. Thus, most of them are far away to fulfill the dream of environmentally responsible mobility. Nevertheless for the most this dream is hardly affordable, because nowadays a simple basic version of an electric vehicle costs at least 15.000 Euros. In addition, also driving range and passing up to about 130km/h are important criteria for future customers. Today only the Renault Dezir and the Tesla Roadster reach these values, but costs more than 100.000 Euros each. In principle most of the potential customers are very open minded considering the new mobility concept, but the claims are still far above what today‘s industry can provide. Therefore, electric vehicles are still far away to be the first choice for customers and a sudden massive introduction of the electric drive is a long way off. However, innovations in electronic technology could boost the necessary effect to persuade drivers in the future to buy an electric vehicle rather than a conventional car. Even today first steps are taken in this direction, such as the feverish development of the battery as well as a Range Extender. An additional energy storage, which is designed to operate automatically while driving to relieve the main battery and extend the reach of the car.

Above I Non affordable electric vehicles for the Genaration Y
From right to left: Tesla Roadster, Audi E-Tron, Chevrolet Volt, Nissa Esfolw and Renault DeZir

Trends in Transportation Design

Show and concept cars depict a latest trends, possible futures and the various opportunities for transportation design in general. The fascination of young car designers, who express their creativity and abilty to change the way of established dogmas with their creative potential. Trendsetting vehicles give an insight into the car makers vision of future mobility.

Above | The Toyota Prius C concept previews the third generation of the hybrid vehicle

Left | Mercedes benz Bluetec Hybrid

Hybrid

A hybrid drive is a vehicle mixing two different energy types. The most common hybrid layout is the combination of a combustion engine and an electrical machine with a high energy storage. The recent quantum leap in energy storage now makes it possible to use it affordable in serial car production.

Below | Mercedes Benz F-Cell Roadster - Fuel Cell hybrid drive

Above and left| BMW X6 (2009) and BMW GT (2010) are two cars unifying several vehicle classes

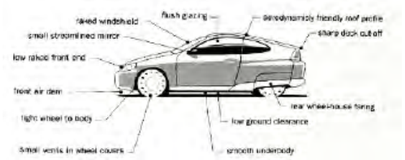
Crossover

Currently, a trend could be found which produces cars that can be classified into a category no longer accurate. These vehicles are hybrids that are a pastiche of different vehicle classes. In the best case these vehicles combine the advantages of different classes and eliminate the disadvantages. This experiment led to variable results in 2010.

Below | The Mini Crossover Concept (2008) is a mixture from city car and off-road vehicle and establishes a highly functional interior wit the introduction of the Center Rail system

Above | BMW EfficientDynamics Concept airflows

Above left | H-Point: Economic car design



Aerodynamics

Aerodynamic requirements have traditionally been dominated the automotive industry. Design flow is one of the newer developments in this field. These attempts shapes from nature for a further improvement of the cw value (drag coefficient). With the proliferation of electric drive and the rise in oil prices, aerodynamics are becoming increasingly important.

Above | Renault Zoe Z.E. concept car

Center right | Sketch for the BMW i3 Megacity Vehicle

Electric

Pure electric drive systems are becoming increasingly sophisticated. The electric drive is the widespread drive with internal combustion engines superior in many properties. For example, the much higher efficiency, and a great torque and power characteristics of the electric motor, and the almost complete freedom in terms of local emissions and noise pollution.

Below left | The Pinin Farina Blue Car concept uses solar cells for the support of tertiary systems

Below right | Mitsubishi i Miev

Above | The Aston Martin Cygnet is the companies first entry in the micro compact class and a breaks taboos of the venerable luxory firm

Right | Smart ED, serial production 2011

Mikro

With the success of the Smart Micro Compact car the micro category observes a huge increment of growth. Small cars evolve from cheap transports to aesthetic vehicles offering high comforts and good manufacturing. With the newest trend high class car manufacturers like Aston Martin introduce a micro car class in their product line. With elctromobilty new classes evolve even below the micro class

Below left | The Toyota IQ shares the same chasis with the Aston Martin Cygnet

Below right | The concept car for the Renault Twizy

Left | Toyota Winglet concept: A personal transportation device

Alternatives

With the popularity of electromobility new vehicle concepts arise. The car industry tries to express the change in mobility in a change of design. Segway cars, E-Scooters and new vehicle classes emerge that fit into the concept of low range and megacity traffic. These new vehicles and products try to open up mobility to new user groups and finding new flexible ways of transportation.

Above right | Segway devices connected to the Opel Flextreme concpet car

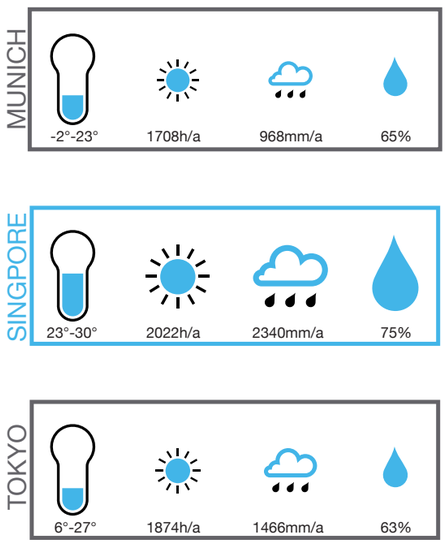
Below | Smart E-Scooter and E-Bike concepts

Population, Urbanism and Housing

Singapore‘s specific singularities in population, density, ethnicity, infrastructure and housing are researched, collected and filtred to create a representative section through the life in this very special, tropical megacity. A pamphlet about the city‘s community, urbanism, transportation and lifestyle defines the need for future mobility and infrastructural evolution. The study establishes a basis and DNA for the design of a megacity vehicle in tropical regions wit the special focus on Singapore‘s singularities and specific demands.

Left I Climate statistics of Munich, Singapore and Tokyo

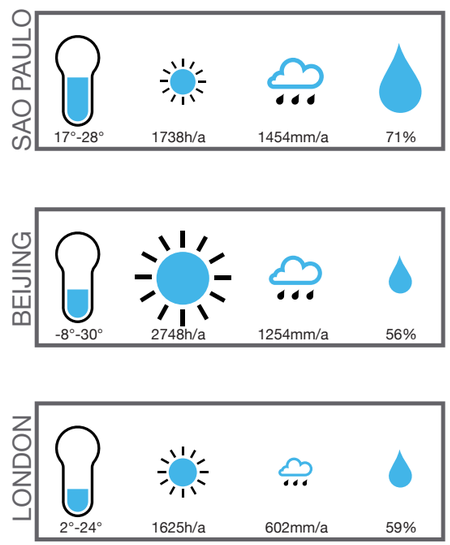
Below I Rain shadow effect shown in Singapore

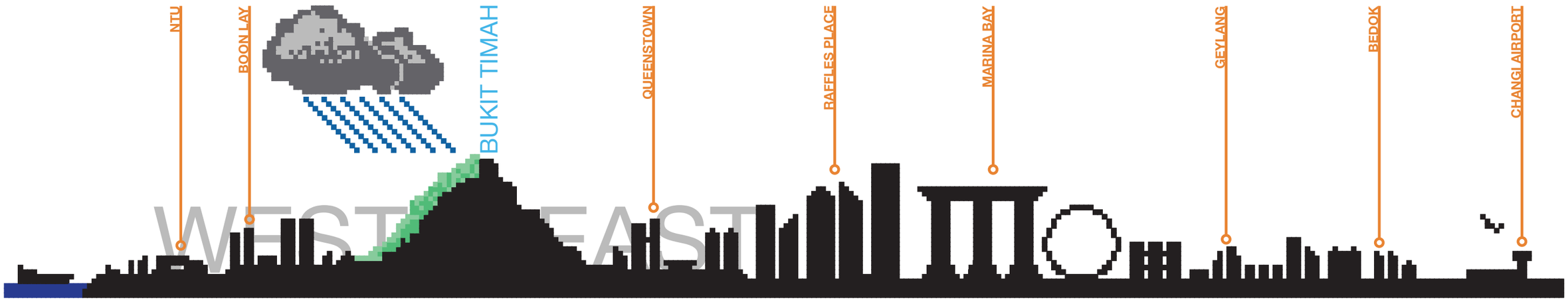


Singapore‘s climate

Due to Singapore‘s geographic location, which is just one degree north of the equator or about 120 km, its climate is classified as equatorial, without any true distinct seasons. In general Singapore is warm and humid the year around, with temperatures never dropping below 20° Celsius. Usually they are climbing up to 35° Celsius and humidity is reaching the 75% mark. Another fact of Singapore‘s geographical location is the abundant rainfall. The average annual rainfall is about 2340mm. [24] Considering this, there‘s another phenomenon about rainfall in Singapore. Although it is a very small country there‘s more rainfall on the western side of the island than on the eastern one, due to the so-called rain shadow effect. A rain shadow is described as a dry area on the lee side of a mountain or sometimes a hill. The mountains block the rain-producing clouds, casting a shadow of dryness behind them. Thus, Singapore has it‘s only bigger elevation in the 166m high Bukit Timah, but it causes this phenomenon and therefore there‘s sunshine on the eastern side, while it‘s raining on the western side. This is the reason why the eastern side of the country is much drier and slightly hotter than western Singapore. The monsoon season happens twice a year in Singapore and is another contrast preventing the country from all-year uniformity. From December to early March the Northeast Monsoon ravages Singapore and from June to September the Southwest Monsoon occurs.

Right I Climate statistics of Sao Paulo, Beijing and London





Above I Heavy rainfall over Singapore seen from the 26th floor of the Plaza Building

Heavy rain

Rainfall in Singapore is quite heavy, but short and very regular even in months without Monsoon. Therefor the average rainfall is about 2340mm per year. The average humidity mark of Singapor is about 75%, but right after such rainfalls it raises to alomst 100%.

Strong solar radiation

Due to its geographical location, 120km north from equator, the solar radiation is almost perpendicular and therefore very intense. This is the reason why Singaporeans are wearing umbrellas during sunshine, to protect themselves from the strong ultraviolet radiation.

Above I Singaporeans are protecting themselves from sunshine

Singapore - a global city

Singapore is a city of constant change. A city of utopian qualities and visions. A city of cultural and ethnic diversity. A massive urban laboratory of exuberant speculation and data-driven exactitude. (...) A petri dish of architectural postulations, urban planning policies, social and economic implementations.“ [26]

Singapore‘s growth of the past 50 years since self governance have been a story of success, coming close to the urban architectural visions that precede it.

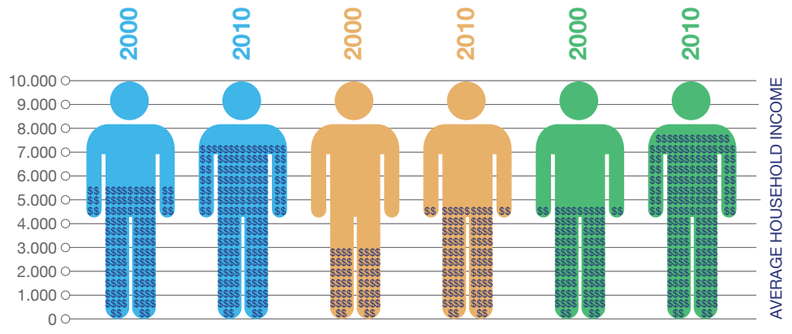
It survived two financial crises (1997 and 2008) and two outbreak epidemics (SARS in 2003, H1N1 in 2009) relatively unscathered. 2011, the tourist visitors numbers have reached record numbers, the real estate is booming.

But what does it mean to be Singaporean?

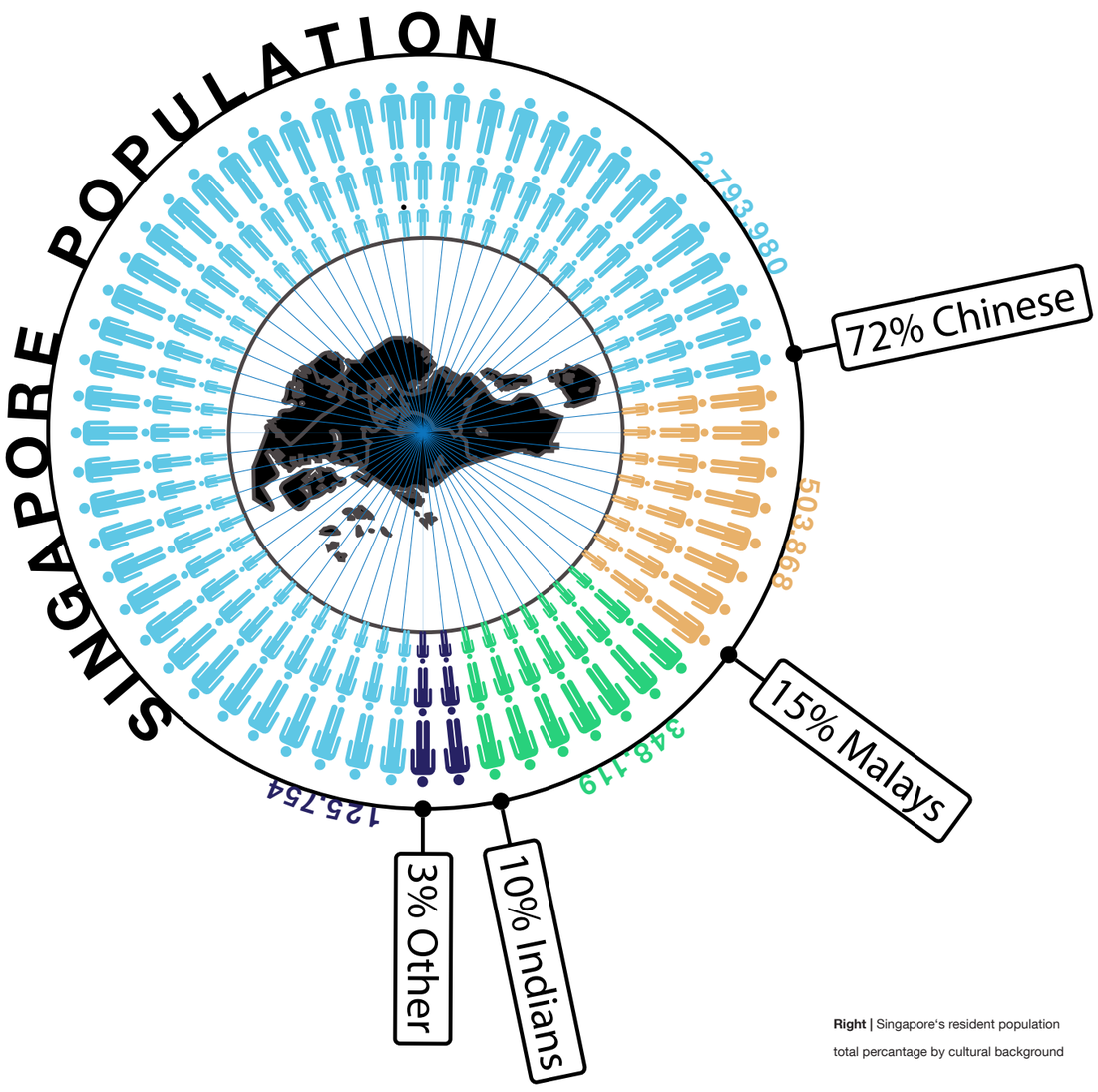
Singapore is a conglomerate of cultures; Malay, Indian and Chinese maintaining their strong individual, religious, cultural and ethic values. Even though the city‘s getting more and more westernized, a lot of traditions and customs remain untouched. So is there a common value system, a comprehensive identity and - most of all - a mutual future of Singaporean development?

Mixing of cultures is foreseen by several governmental measures - they foresee no religious education at school and a strict quota system of cultural backgrounds in housing programs. [27]

Neo-confucian ideals, claimed by the government, base on unconditional obedience towards family and authority, hard work and discipline. These strict and clear conception are reflected in Singapore‘s meticulously planned layout of its future image and urban development.



Below Left | Average household income by cultural background in 2000 and 2010



Right | Singapore‘s resident population total percantage by cultural background

Both Pages | Singapore's resident population percentage by cultural background in each planing area

WASTE TREATMENT IN SINGAPORE

POWER PLANTS IN SINGAPORE

EXTERNAL CONNECTIVITY

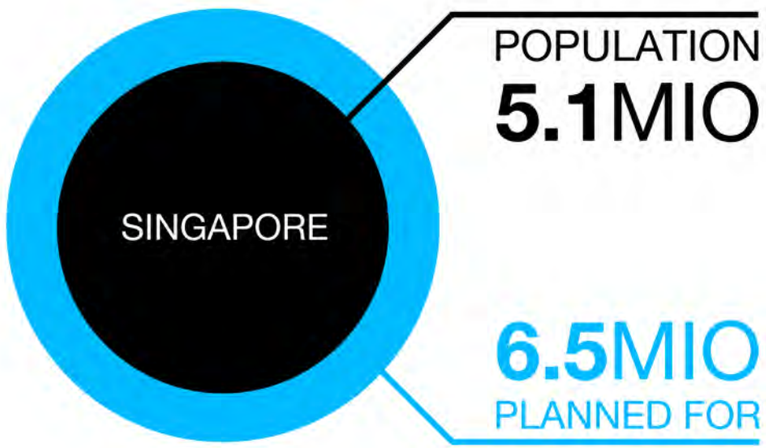
WATER WORKS IN SINGAPORE

Singapore‘s Urban Development Plan

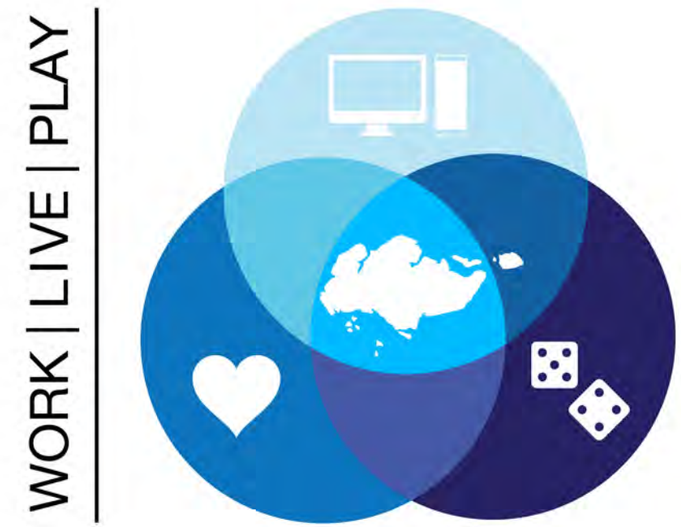
After 30 years of planning - outlined by the Urban Development Plan, setting the strategic land use and infrastructure for the next 40-50 years - first quantifiable results became visible in the 90s following the pattern of compact development.[28] The plan was first developed in 1971, being reviewed every 10 years since then for a collective forward thinking.
Due to Singapores unique position as an island city state it always had to adopt its land conversation as core policy; accomodating several activities besides housing, business and recreation that are normally located outside of the city centers borders such as power generation, airports, water chatchments, waste disposal and defence needs. [29]

High Density

As a compact small-island city state; Singapore is highly dependent on its high-density and transit-oriented infrastructure. As of today, there reside 5mio people within Singapore - already being prepared for future growth. On only 710 sq km; the Singaporean Urban Development Plan foresees an additional 1.5 mio residents - land use and transportation being able to house a total of 6.5 mio Singaporean.
Singapore is using its limiting factor of space as an advantage. Jeffrey Ho, Director of the Singaporean Design Council, argues that a compact city can be seen as the most sustainable urban form and many therefore adopting Singaporeans compact development policies[30] - a role model especially in the South-East Asian region.



Below | Singapore‘s current population and an outlook to its capacity concerning land use and transportation



Right | Work, Live and Play - the mission statement of Singapore‘s Urban Development Plan introduced for the Marina Bay Project

Singapore‘s model of a compact city vs. sprawled urbanism

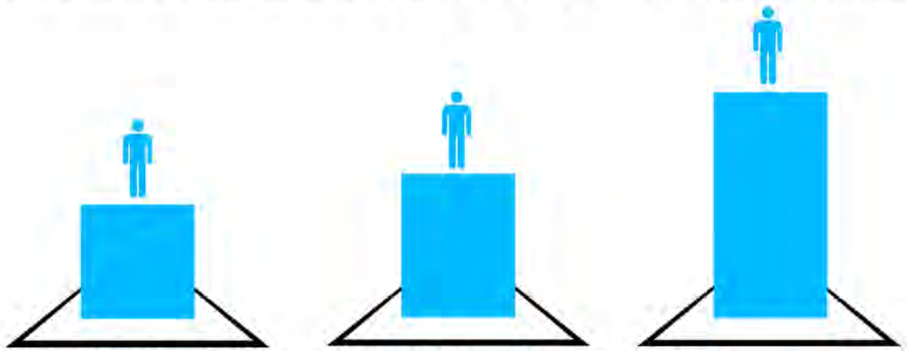
Compared to traditional forms of urbanism in growing cities, Singapore‘s concept of a high density comes with several advantages. A further sprawling of the city would mean higher dependance on cars and roads while public transport couldn‘t be maintained as sustainable.
The less insufficient the population catchment and the longer the distances between urban center and the edge of the city - with neighbourhoods being further removed from periphery - the more constant fiscal injections to sustain operations and maintenance are needed.

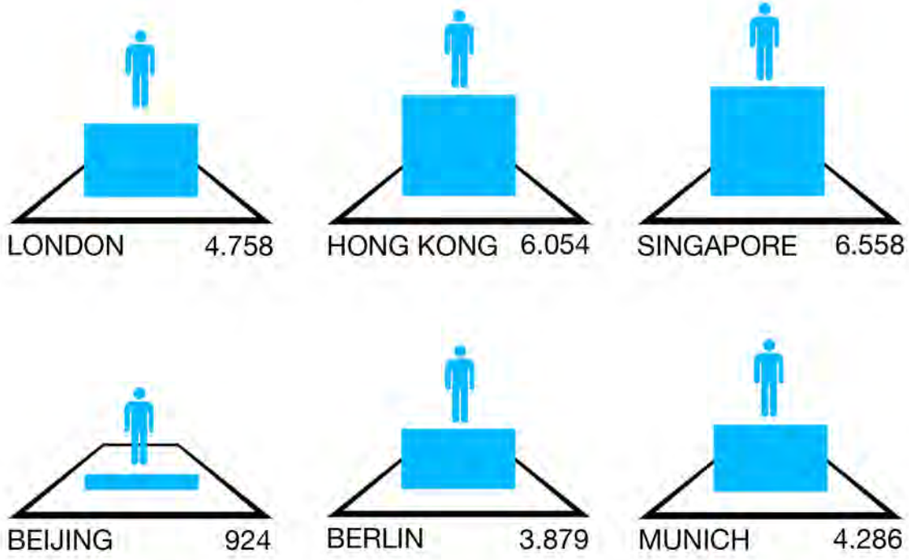
Vertical Urbanism

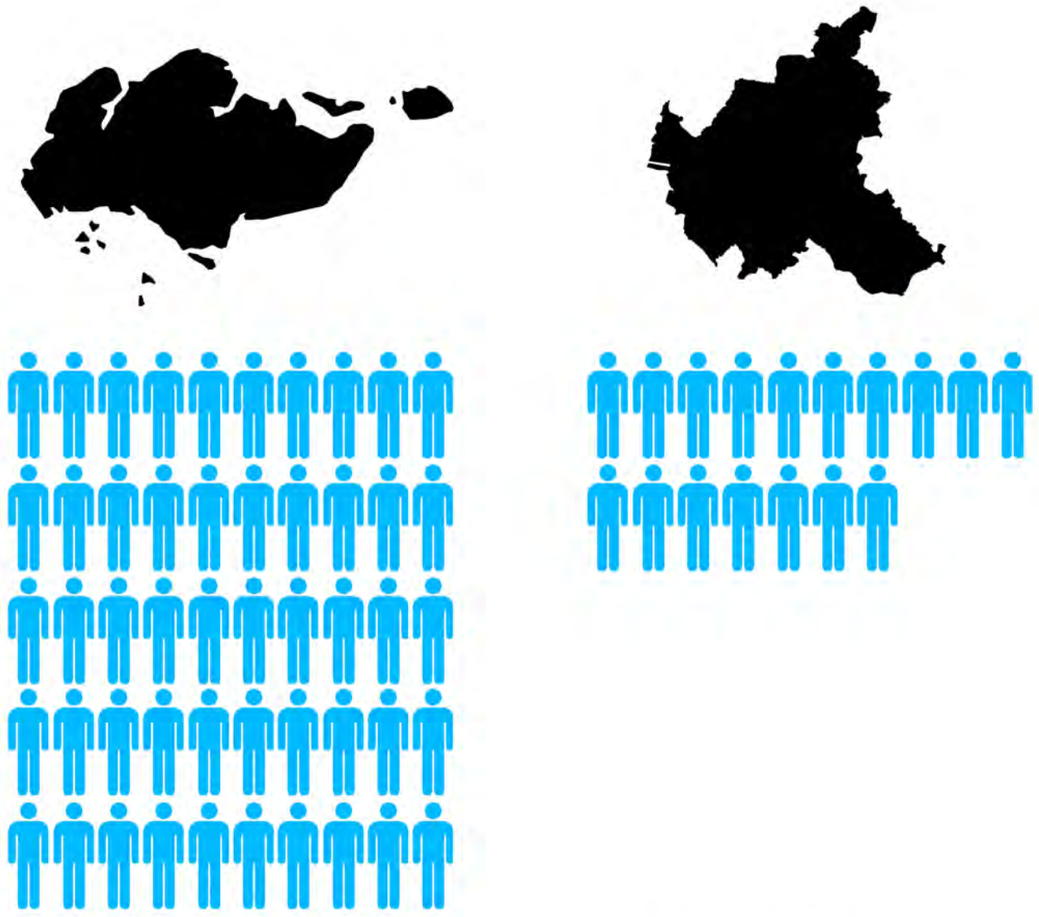
As a result to Singapore‘s compact urban plan, it‘s development is not branching out horizontally but vertically - stretching the conventional vision of infrastructure within a city. The lines between street level and higher and lower storeys are blurring through an effective use of underground space and steady connections overhead between building complexes, the necessity to actually leave a covered shelter shrinks. Instead of freestanding monoliths within the urbanscape, buildings form networks. [31] This vertical infrastructure provision also spatially seperates the streetlevel from the sidewalks or: the people from the traffic.

POPULATION DENSITY

HOW MANY PEOPLE LIVE IN ONE SQUAREKILOMETER OF SPACE





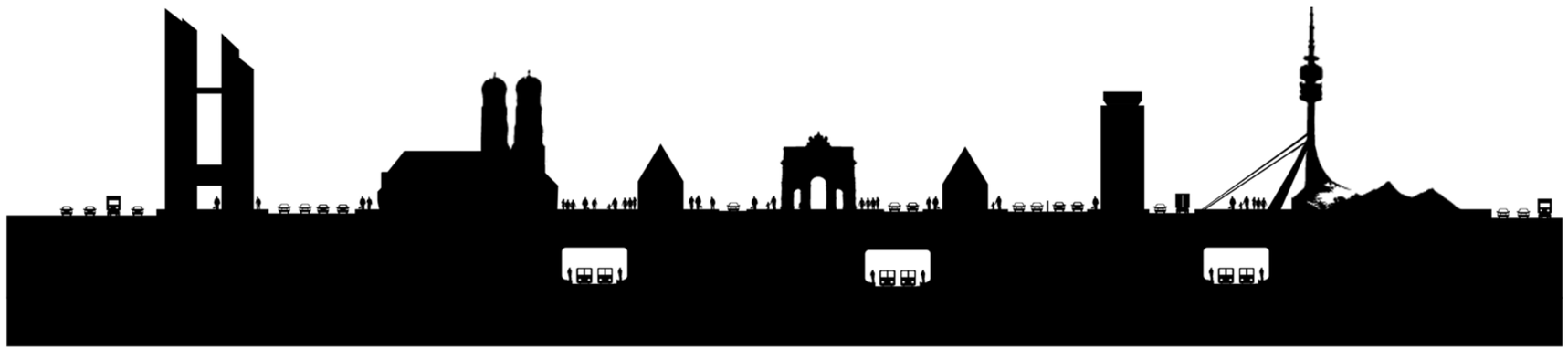


SINGAPORE

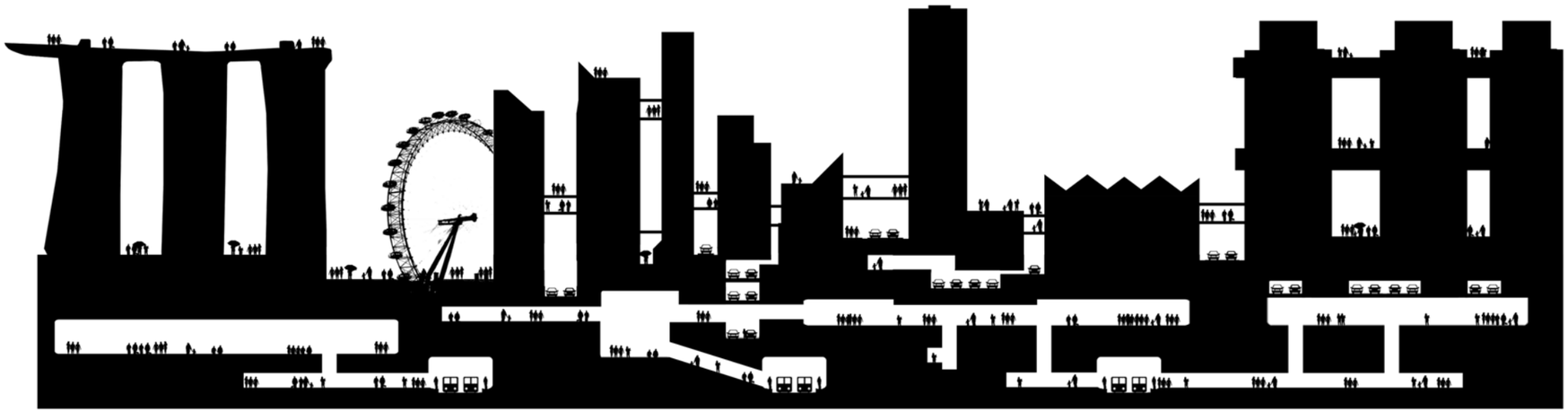
AREA: 710,2 KM²
POPULATION: 4.987.600

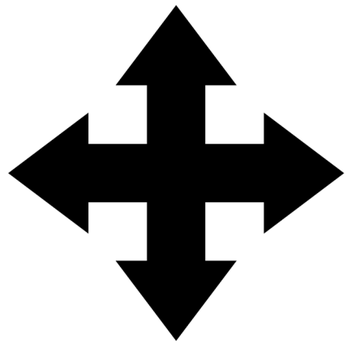
HAMBURG

AREA: 755,3 KM²
POPULATION: 1.786.278



MUNICH ABSTRACT SECTION





SINGAPORE ABSTRACT SECTION

Opposite Above | The two different leasehold plans- to choose from for HDB owners

Opposite Below | Proportional distribution of Singapore's population living in HDBs and their percentage of owners

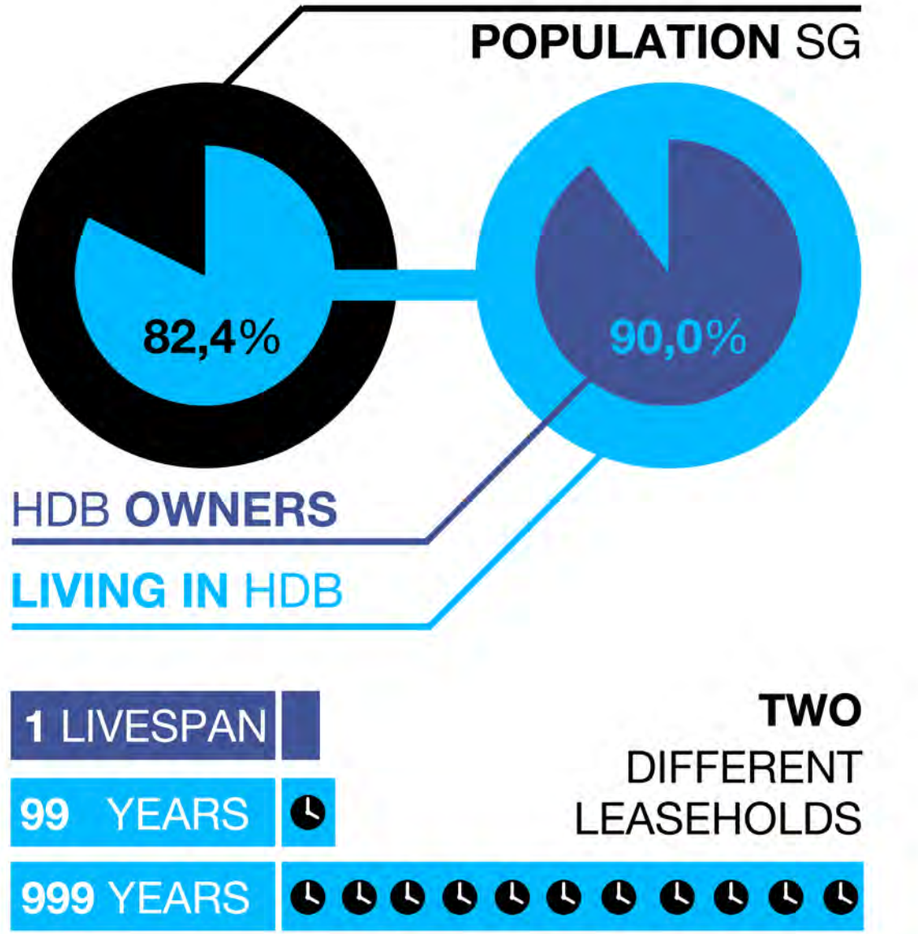
The Housing Development Board

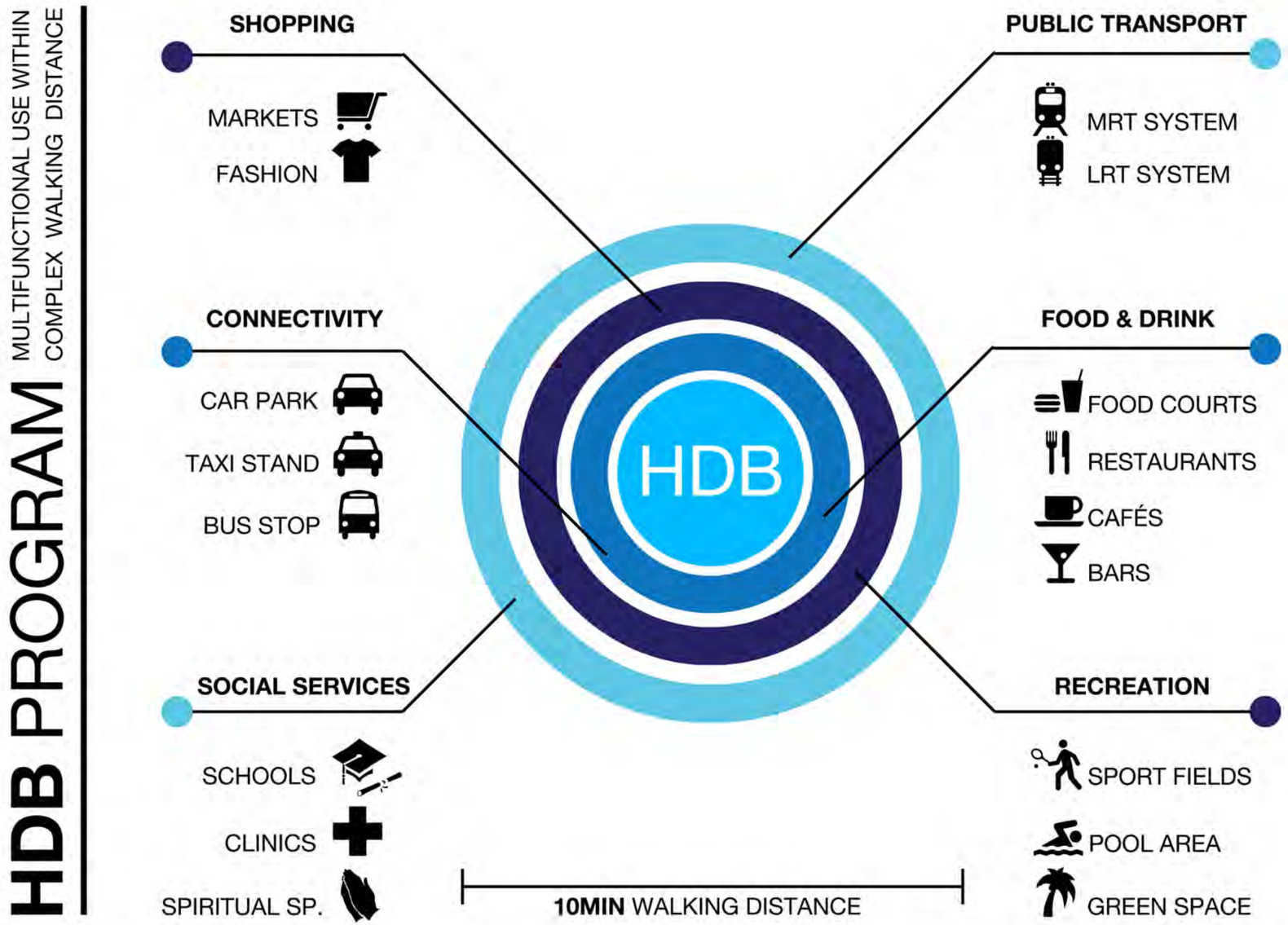
The bedrock of Singaporean society has been its approach to affordable, community-based quality housing by the Housing Development Board. 82% of Singaporeans live in a HDB flat, 90% of which even owning their units, having the option between 99-year or 999-year lease- and freehold plans. The board uses several ways of subsidiation for its tenants, like demographic quotas, rebate schemes, family bonuses and generational proximity incentives.
Contrary to other cultures, „public housing" doesn't come with a negative connotation or runs the risk of becoming a ghetto of economically and socially disprivileged in Singapore, each HDB offering a representative cross-section through society living next to each other door to door.
Most HDB share common ground when it comes to construction: raised on a pilotis, their ground floor, called ‚void deck' opens to the next block as a public space weaving through; its openness being a statement against the walled-in gated condominium projects.
The execution and delivery is perfected in its own Prefabrication Technology Centre; being constructed out of narrow slab blocks, single loaded corridors, ventilated wet areas, open foyer and slap overhangs due to tropical necessities.[32]

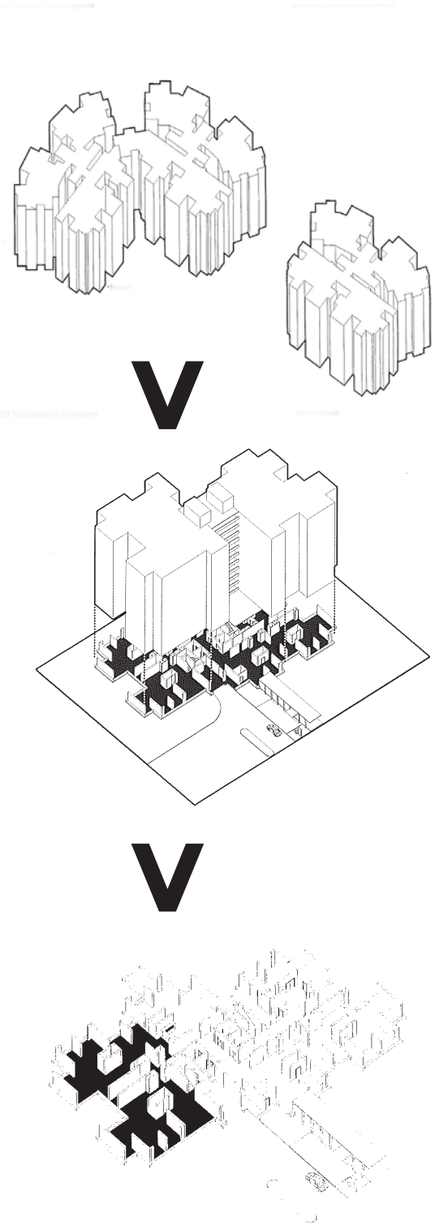
All of them share differently weighted design principles given by the board:
- 30% design requirements for GPR, flat mix and yield
- 30% design excellence, excellence, distinctive with a creative response to the context and innovative design
- 20% site layout, landscape, vehicular and pedestrian traffic
- 15% distinctive block identity, facade and building features, security, safety, privacy
- 5% other innovations and sustainable features, especially being prioritised recently.[33]

HDB - Taking Housing beyond architectural typology

But the concept of HDBs far exceeds merely being an architectural housing typology. Most complexes include a variety of services and amenities such as markets, shops, schools, medical clinics, parks and sport centres. Cheong-Chua Koon Hean, the CEO of the HDB & Deputy Secretary for Ministry of National Development, sees the future of HDB housing as self-sufficient towns that reduce the need to travel, interlinking public and private space and „an active part to create communities - a meta project integrating architecture with governance, social systems, finance and infrastructure."[34]







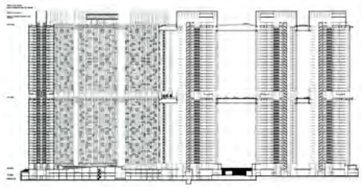
Opposite | Exemplary progam of social services, ammenities and infrastructure within an HDB*s walking distance

Right | Zoom in typical building typologies of HDB housing in axonometric view

1. Butterfly Block typology
2. Point Block of HDB
3. Void Deck on ground floor

The Pinnacle@Duxton Project

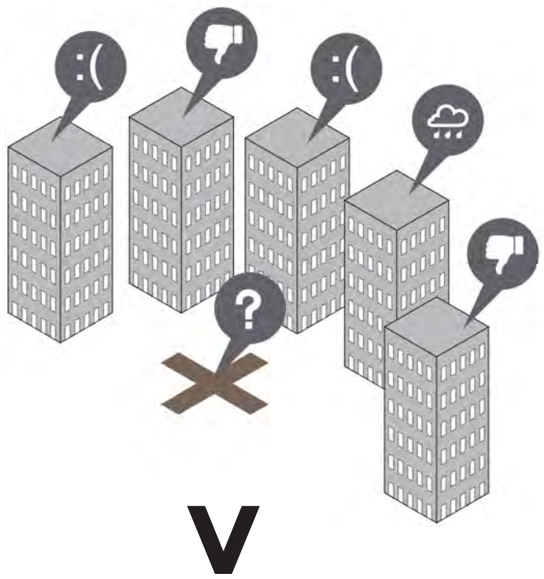
Though old HDBs are constantly remade and cleaned with increasing density and heights within the city, new visionary projects are supposed to replace the old structures in the future.
The Pinnacle@Duxton Project, completed 2009, at the edge of the Central Business District is the current prestige project of Singaporean housing. Consisting of seven 50-storey connected towers with a total of 1,848 units, it represents the worlds tallest Public Housing building.
It brings along hundreds of cafes, restaurants, pubs and shops within a ten minute walking distance; includes an 800m running track and an urban mountain path with sea view, a commercial centre, food court and several playgrounds.
Two MRT stations are integrated in the complex, less than 300 metres away from the housing units; its linear park at the eastern boundary is a part of Singapore‘s Green Link Plan. With its two sky gardens, being the world‘s largest with almost 1ha, the whole Pinnacle Duxton forms a walkable, high-rised neighborhood of its own.[35]

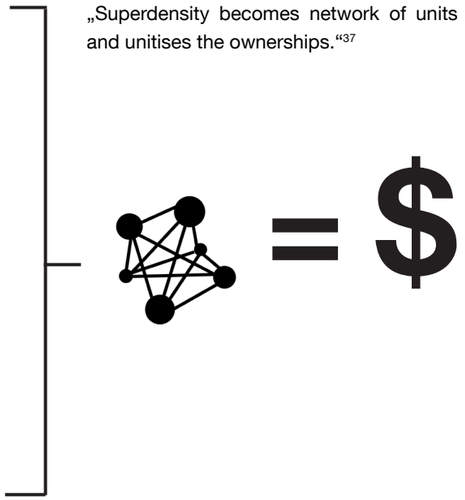


Opposite | Picture of the prestige HDB Pinnacle@Duxton

Right Center | Plans of the Pinnacle@Duxton
1. Site Plan
2. Third Storey Plan (New Ground)
3. Sectional Elevation

Right Below | The Pinnacle@Duxton‘s Advertising Campaign as presented on the official homepage





HDB Expansion Funding

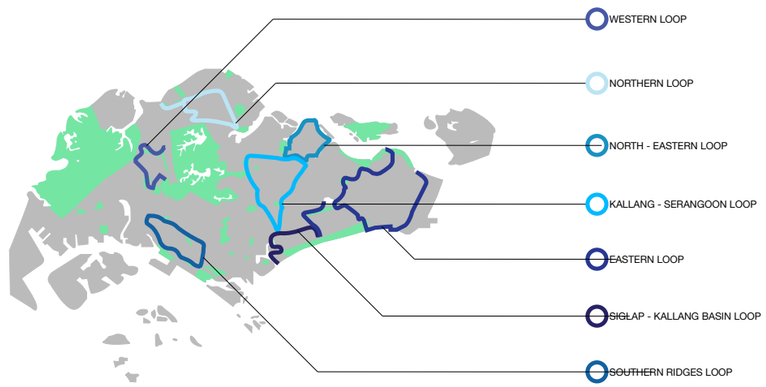
Due to Singapore‘s high percentage of flat owners, there‘s a strong connection of residents to their units - the term „buying an HDB together“ often being synonymous to „getting married“.
Often, Inhabitants even form internet based communities for administration within their housing complex.
These unique conditions of mass ownership encourages personal stakeholdership and individual commitment[36]; connected housing complexes can join together for shared investments and expansions. For example, a new shopping mall of S$50 Mio would be divided to S$27.000 per household; roughly equating to 5% of each units value. The increase in value is directly built into purchase price. With larger number of units and the ongoing linking of HDB complexes comes greater possibilities, such as own streets and power plants. „Superdensity becomes network of units and unitises the ownerships.“[37]

Green Plan

„City in a Garden“ - that‘s what Singapore merchandises itself as. Its approach to urban greenery is exemplary compared to other Asian cities. It‘s Green Link Plan foresees a continous Park Connector Network of 360km, bringing together all parks in Singapore and making it possible to circle around the whole island without every having to step on concrete, both on ground level as well as High Rise Greenery.
However, in 2000 Singapore was among the worst ten cities in a ranking of the environmental sustainibility of 122 countriey worldwide.[38] Except the 163ha piece of almost undisturbed forest at Bukit Timah Nature Reserve, all greenery in Singapore has been artificial since the Tree-Planting Campaign has been started in 1962 by Lee Kuan Yew. More than 95% of the original forest cover (~578sq km) has been cleared. Despite Singapores high ambitions, critics see their approach to urban greenery as „superficial decoration“ compared to a real urban jungle. Jörg Rekittke, Associate Professor of Architecture at the National University of Singapore, passes criticism on it for being „a stereotypical copy of the western landscape garden“ and „mostly looking streamlined, exchangeable, somehow faceless and manicured.,“[39] following too streamlined of a pattern without individual identity:

Waste Management in Pulau Semakau

Pulau Semakau is an artificial waste recycling island located 8 kilometers south of Singapore, covering 3.5 square kilometers. Its landfill will approximately satisfy the city‘s waste deposal needs until 2040. The area inside the landfill is divided into eleven bays (known as „cells“), which are lined with thick plastic and clay to prevent any harmful material from seeping into the sea. Since it‘s been put in use in 1999, four of the eleven cells were filled and covered with vegetation to create an island containing rich ecosystems. [40]



Streetscape Greenery Master Plan by the Singaporean Institute of Landscape Architects (SILA). [41]
1.) Parkway - for urban areas
2.) Forest - for roads by the rainforest
3.) Coastal - for roads near the sea
4.) Rural - for roads through the open countryside
5.) Gateway - for dramatic points of entry

Opposite | Principe of HDB complexes funding their expansions

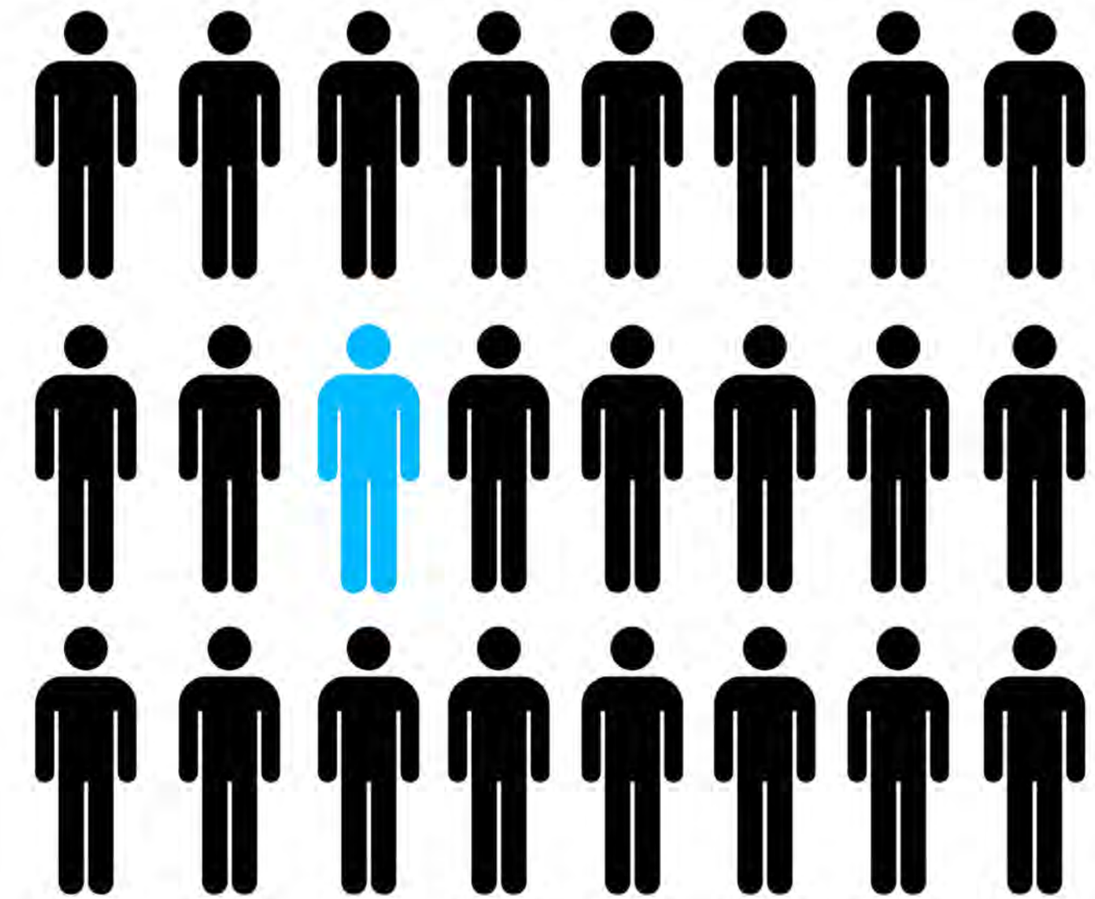
Below Right | Singapore‘s Park Connector Network

Critical Voices

As Singapore‘s population is materially better endowed since its economic boom and its population turns more sophisticated, criticism and frustration arose. Despite all its compactness, people are looking for space, privacy and isolation; having the need for not only speed but also slowness. And albeit the strong promotion of community thought Singaporeans want to retain their individuality. A 1996 survey among Singaporeans aged 21-30 revealed that the majority wished for better housing; „moving on from merely fulfilling basic human needs[and] adressing a changing demographic eager for individualised self-definition“. [42]

Puplic Perception

Designer and Curator Erik G. L‘Heureux concludes the impression of many people visiting Singapore: „too green, too efficient, too clean, too successful, too authoritian, too commercial, too food centric, too hot, too dystopic, too themepark-like, too boring, too generic“[43] and points out the striking resemblance to Sir Thomas More‘s seminal image of Utopia in 1516 in his „Truly Golden Little Book, No Less Beneficial Than Entertaining, of the Best State of the Repubic, and of the New Island Utopia“: the picture of an supposedly perfected but unreachable society. [44]



Disneyland with Death Penalty

Opposite | Woodcut of Sir Thomas More's Vision of Utopia by A. Ortelius (date unknown), put in relation to the Island of Singapore

The most lasting impact on Singapore's image was coined by William Gibson in his 1993 article „Disneyland with the Death Penalty" for the Wired magazine. In his article, he describes his clean, bland and conformist impression of Singapore during his stay. He calls the whole island a ‚g-rated experience [with] the feel of a very large corporation", its inhabitants having an unhealthy obsession with consumerism. The origin for this lack of creativity and alternative or dissident style according to Gibson are rooted in it's history, being built atop an equally peculiar „theme park" to meet the longings of the British Empire in the 19th century. Due to the recent history and development of Singapore, he also points out the complete lack of any physical experianceable past and concludes:

„Ordinarily, confronted with a strange city, I'm inclined to look for the parts that have broken down and fallen apart, revealing the underlying social mechanisms; how the place is really wired beneath the lay of the land as presented by the Chamber of Commerce. This won't do in Singapore, because nothing is falling apart. Everything that's fallen apart has already been replaced with something new. The word infrastructure takes on a new and claustrophic resonance here; somehow it's all infrastructure." [45]

Portrait of a Potemkin Metropolis

Rem Koolhaas equally contributed to the negative public perception of Singapore in the 90s with his essay „Singapore Songlines: Portrait of a Potemkin Metropolis; or: Thirty Years of Tabula Rasa". Already in the title, Koolhaas links Singapore's demeanour to the story of Russian officer Grigori Aleksandrovich Potemkin of the 18th century: According to popular saying, when the ruling empress, Catherine the Great, came to inspect his areas of land he ordered to built fake, non-existing villages along her travel road - giving a perfectly working and happy impression of the cities while hiding the real weaknesses of his administration. Similiar to this construct of facades and Mock, Koolhaas denies Singapore all credibility, being „stripped of the last vestiges of authenticity and dignity [where] tropical heat and humidity are (...) the sole surviving element of authenticity", therefore lacking any authentic, metropolitan feeling.[46]

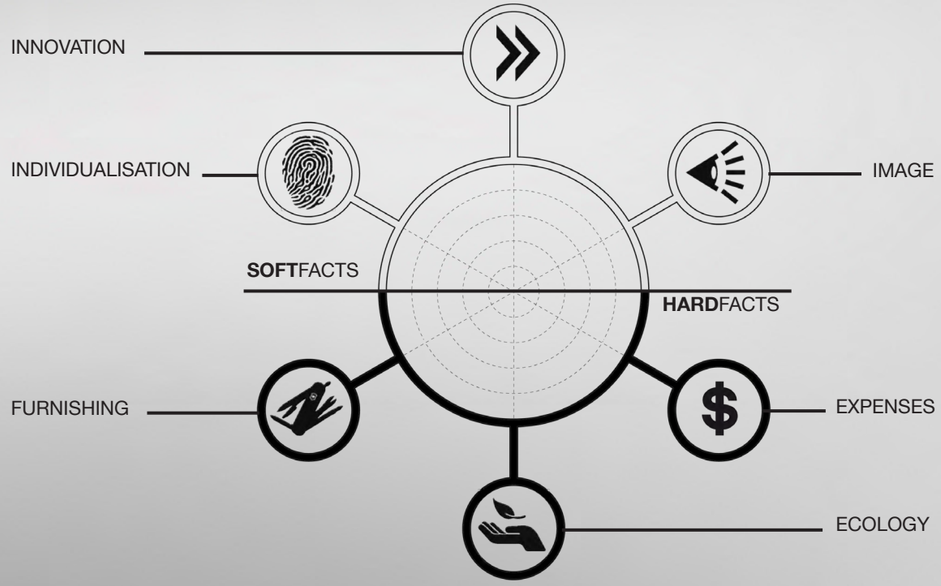
Tang Weng Hong gave a critical response to the harsh accusations on Singapore from foreign countries, complaining Koolhaas never being able to give a real definition of the supposedly lacking „authenticity" and claims Gibson and Koolhaas giving a superficial judgement thinking Singapore lacks history just because there is little physical manifestation.[47]

Project Specific User Groups

Several interviews with a diverse amount of Singaporeans showed a profile of the city‘s inhabitants and their behaviour towards living and modes of transportation. Specific Users Identities, their characteristics, preferences and behaviour were developed for the TUM Create Future Mobility Project.

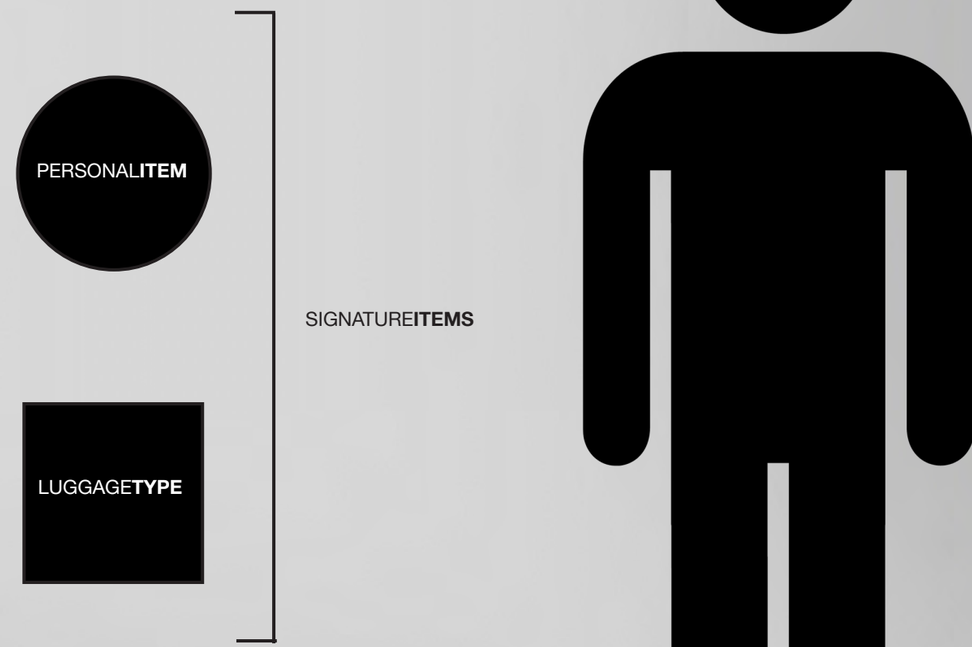
USER**PROFILE**

AVERAGE AGE | SIZE OF HOUSEHOLD



/phonetics/ etymology [word meaning]

Profiling of Singaporean user archetypes and classification as target audience:
1. Socio-demographic target audience (age, sex, education)
2. Target audience according to behavioral characteristics (first buyer group, intensive user)
3. Target audience according to psychological features (forward thinking, safety oriented)
4. Target audience according to media oriented characteristics (users of certain medias)
+ evaluation of key factors.

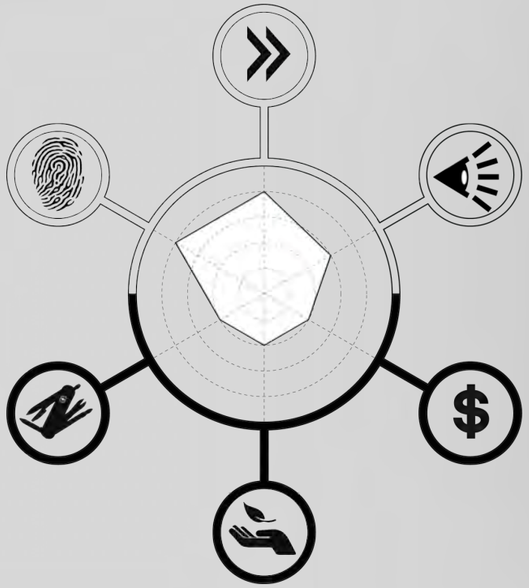


SIGNATURE**ITEMS**

HARAJUKUKEI

原宿-ヴィ

AGE: 20-35 | HOUSEHOLD:



hæræ'zu:ku: kay/ n. Japanese [Harajuku: area in Shibuya, Tokyo; Kei: style]

Within the last decade, there's been a growth of a new generation of Singaporeans; looking for its own, new values apart from being stuck in tradition or copying western rolemodels. As an open minded future thinker, the Harajuku-Kei is looking for innovation and ways of expressing himself in means of customization and individualisation; being unsatisfied with the current state of conformity in housing and mobility. He bases his buying decisions mostly on soft factors, led by emotion and sympathy for a product; often being part of the first buyer group.

SIGNATURE**ITEMS**

THE**KIASU**

AGE: 30-45 | HOUSEHOLD: +

驚輸

‚kiasu:/ n. & a. Hokkien (kia: fear + su: loss, one who is afraid of losing]

The Kiasu is agressive in the bid to get what he wants, not to lose in a highly competitive society. He has the desire to be on top and wishes to enjoy and express his modest wealth; without drifting into the purely luxury segment.
Due to this, he takes an awareness in the image of a brand and user experience out of enjoyment and satisfaction but still bases his fundamental decisions on economic objectivity and measurable values.
His views show an affinity to western, often capitalist, values.

THE**AHCHECK**

صرحف هآ

AGE: 40-60 | HOUSEHOLD: ++

/chek, tSEk/ n. Malay [uncle, a father‘s & mother‘s brother, middle-aged man]

The Ah-Check has a strong connection to traditional values and mystic.
He sees customisation not as a form of expressing himself but choses it out of comfort; seeing the interior of his car as an extension of the private space of his living room. Using it as such, he‘s bringing private belongings for a ‚feel good‘ atmosphere.He prefers a quick and easy to understand interface to number of functions; his buying decision is based on economic, not ecologic factors.

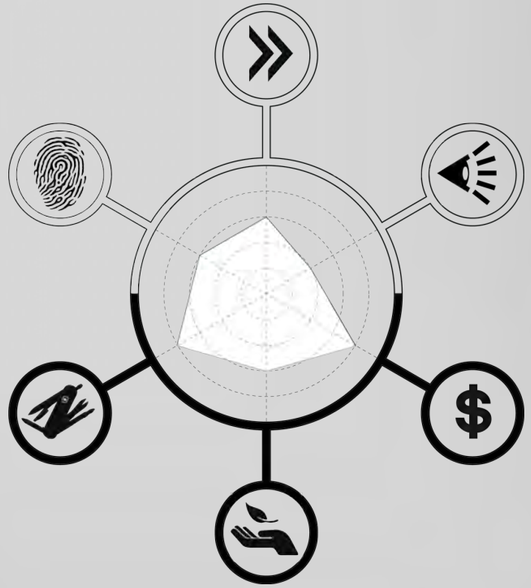
SIGNATURE**ITEMS**

SIGNATURE**ITEMS**

THE**AHBANG**

AGE: 20-35 | HOUSEHOLD: ++

الأخ الأكبر



‚aban/; n. Malay [brother, male sibling, relative or friend of one‘s own generation]

He doesn‘t look at his possessions as an externalization of his personality; and therefore takes no interest in visible customization of a product or image of a brand. Instead of exclusiveness, he has the need of a flexible, reliable equipment and strong safety features and spacious storage when it comes to mobility. He‘s not taking the role of a technical pioneer, but his environmental consciousness is developed.

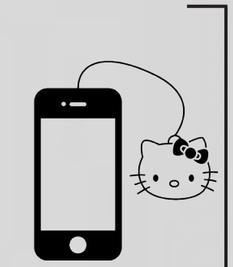
THE**AHBENG**

AGE: 20-30 | HOUSEHOLD:

阿明

/beng, bEN/; n. & a. Hokkien [a common Chinese male name, poss.]

The Ah-Beng likes to present himself as excessively flashy, surrounded by flamboyant, colourful decorated things. What he may lack in sophistication, he shows in willingness to individualisation, therefore he is often connected with modified or zhng-ed cars and has a strong liking to acessories as well as technical gadgets. His attitude might be regarded as superficial and materialistic, often interpreted as showing off.



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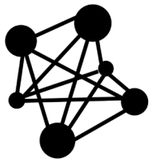


Transportation and Infrastructure

Continuing the diploma research of Singapor‘s urbanism and housing, the students accomplished an elaborate analysis go the island‘s modes of transport and given infrastructure. Singapore‘s transportation phenomenoms, inluding the COE and tax system for private car‘s readmissionsd, Electronic Road Pricing and the lucrative and expanding network of public transport show the city‘s established infrastructure, but also displays it‘s needs in future transportation

TRANSPORTATION IN SINGAPORE

While Public transportation is heavily subsidised, personal traffic is being made more and more expensive. With the introduction of the Electronic Road Pricing gantries in 1998, private automobiles and taxi companies had to pay more taxes every year. The State is working on the MRT network and always trying to expand it.

MRT MASS RAPID TRANSIT

Singapore Subway System is expanding to double it's size by the year of 2020.

LRT LIGHT RAIL TRANSIT

Short Distance Railway consisting of localised rail systems acting as feeder services to the MRT network.

BUS SBS TRANSIT (& SMRT)

SBS Transit currently operates 75% of the scheduled bus market share in Singapore with more than 265 bus services.

AIRCRAFT SINGAPORE AIRLINES LIMITED

SIA operates a hub at Changi Airport and has a strong presence in the Southeast Asiaand "Kangaroo Route" markets.

CAR & MOTORBIKE PRIVATE

Only 3000 **Automobiles** are over 20 years old because of increasing taxes and decreasing refunds.

BIKE PRIVATE

Bycicles are usually seen on sundays in singapore, where tours are organized in communities.

TAXI CITYCAB, COMFORT, SILVERCAB, SMARTCAB, TRANSCAB, PRIME

Taxi Cabs are predominantly operated by large companies, which require a Taxi Operator Licence from the Land Transport Authority.

BOAT FERRY LINKS

Singapore has four **Ferry Terminals**: HarbourFront, Tanah Merah Ferry Terminal, Changi Ferry Terminal and Changi Point Ferry Terminal.

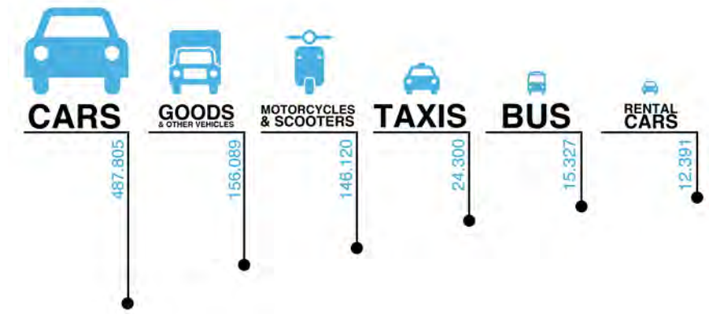
Future Infrastructe's Importance

As completely new scales have evolved in the growing trend of megacities, there's an immense increase in infrastructural, socio-economic and ecological overload and a new dynamism in demographic, economic, social and political processes. All of these new forms of megacities share specific problems with striking structural similarities: Uncontrolled spatial expansion, high concentration of industrial production, unregulated and disparate land and property markets and insufficient housing provision.[48]

However, the key burden than urban growth is placing on a city is on its infrastructure. One on the basic needs of quality urban life besides clean air, water and electricity is the need to be mobile. Millions of people rely on the capability of transportation systems each day - still it's necessary to avoid too much strain on the environment and city budgets.
Especially with todays complex growth of megacities, new city regions sprawl far beyond usual boundaries of one single city - the effectiveness of infrastructure lagging behind populations needs as governance has often not caught up to the new challenges of a metro-regional area.
In the future, mobility will become an even more important aspect of society and one of the main impacts on competitiveness and ecnomomic growth - especially as it's not only essential to move people but also goods and services.
For an increase in effectivity, each transport sector must work seamlessly within the whole system, taking several key factors that influency mobility in account: community, traffic, people and the working world, environment, regulation and transportation policy, technology and organization.[49]

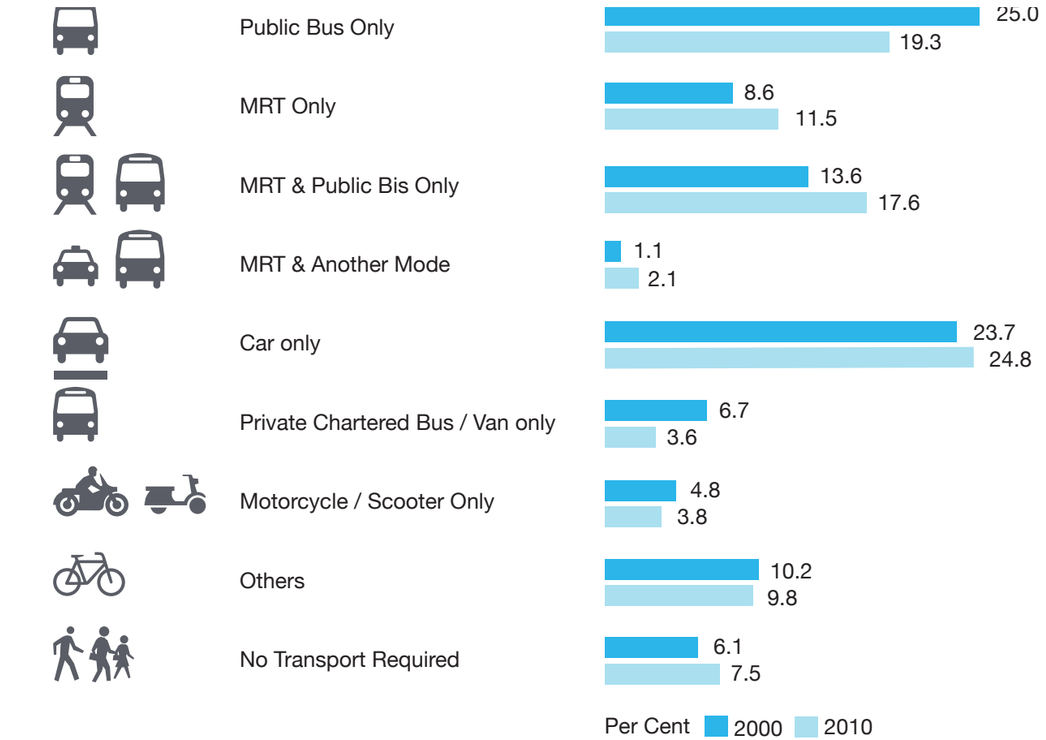
Singapore's Infrastructure

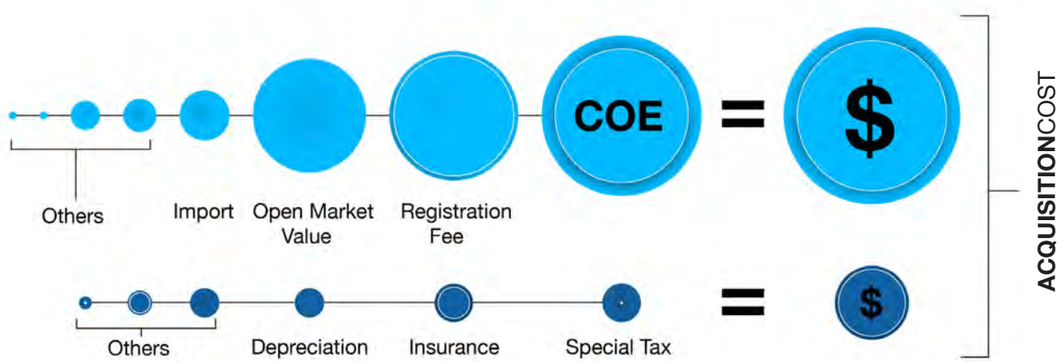
As the key to working high density urbanism is a high-intensity infrastructure, Ashvinkumar, President of the Singapore Institute of Architects sees Singapores urban quality in its large network of transport through roads and Mass Rapid Transit System (MRT).[50] Zoning for higher density areas are laid out around public transport nodes, the MRT and HDB administration working hand in hand. Integration of transport facilities is planned upfront with surrounding developments.
Khoo-Peng Beng, architect of the Pinnacle Duxton Project, emphasizes the importance of infrastructure integration in buildings, as energy consumption per capita for personal needs, transportation and buildings will become more efficient. He sees infrastructure designed as a system for an integrated environment - reducing wastage and redundancies and a help to lower the cost for installation and maintenance (roads, drains, servers, power and communication systems) due the physically shorter runs of Singapores compact nature.[51]

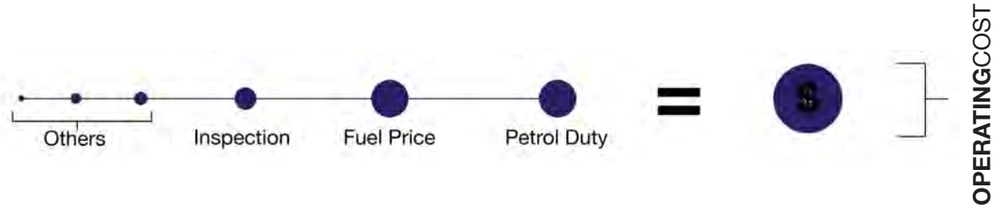


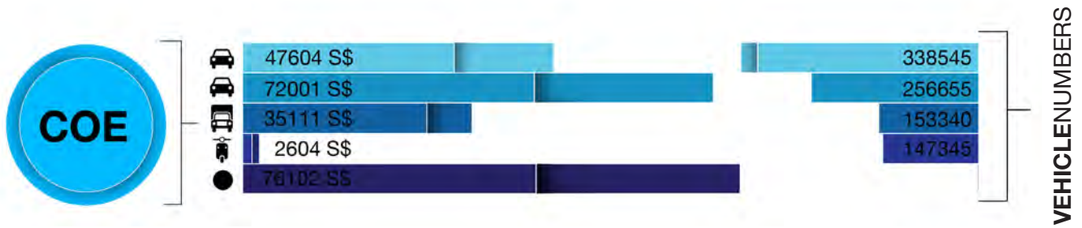
Above Right | Total quantity of vehicles registered in Singapore

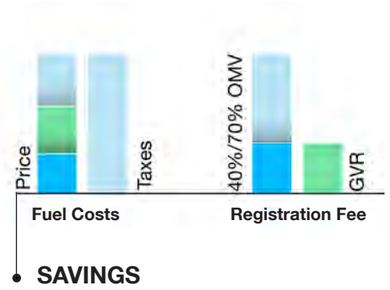
Below Right | Mode of Transportation to work in percent

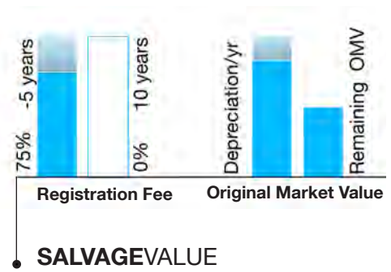


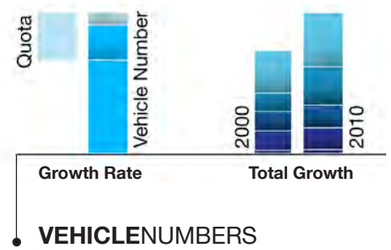












Private Transportation

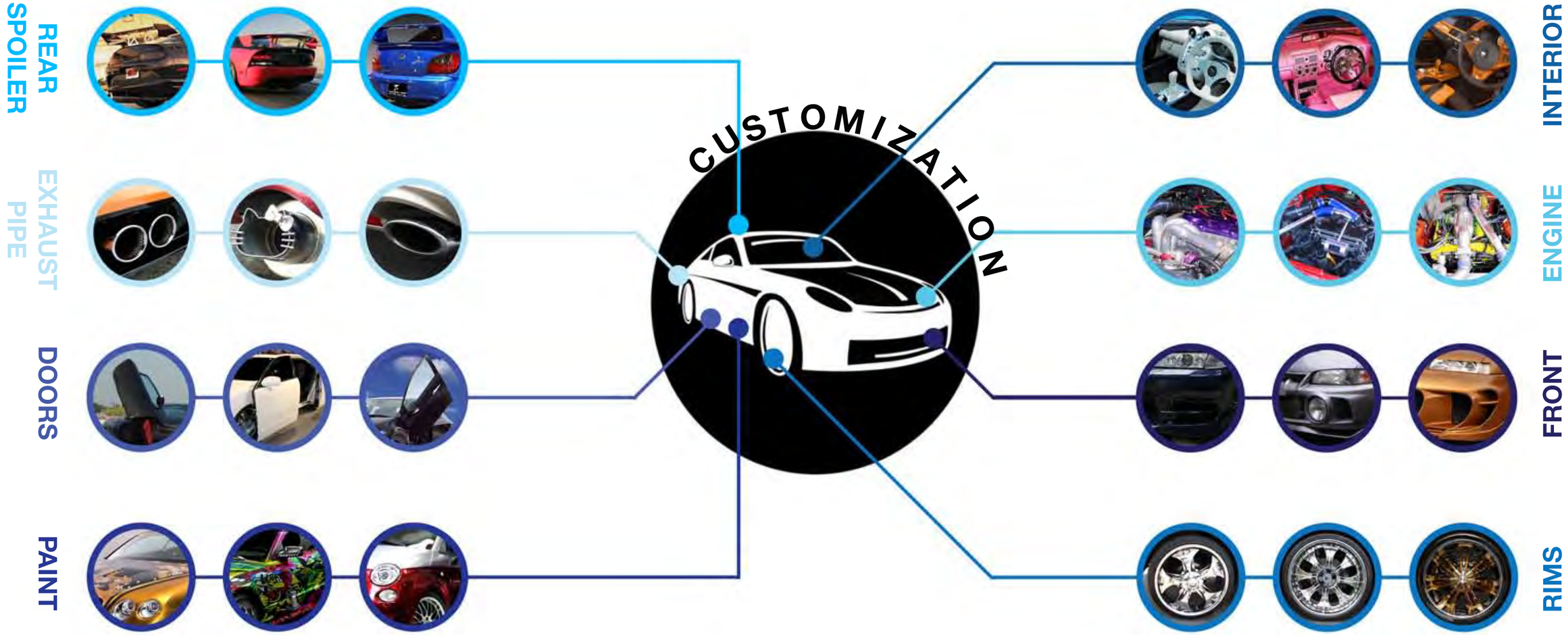
Singapores government takes several measures to ensure public transportation far exceeds ownership: Private car ownership is one of the most expensive investments a Singaporean can make.
Multiple sanctions having been introduced to reduce reliance on private transport and reduce the number of cars; such as road pricing and quotas.
To register a new vehicle, buyers have to bid for a Certificate of Entitlement (COE), of which a certain number are being released each month. Only one bid is allowed per applicant and in case of success, the certificate has to be renewed every 10 years.
Aquisition cost alone for an ubiquitous middle-class car like the Toyota Camry can reach upwards of S$ 100.000 - not counting he high taxes and additional costs
The Electronig Road Pricing (ERP) system of today started in 1998, going back as far as 1975 with Singapore‘s Area Licensing Scheme.

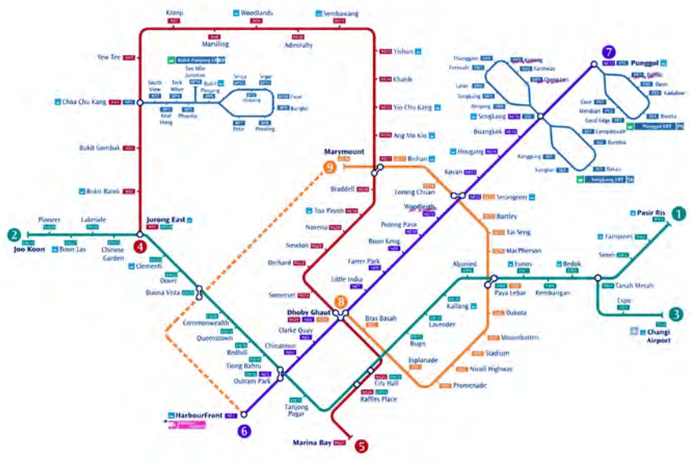
Similiar concepts have been introduced in metropolitan areas all over the world such as London. Depending on time and location, the fee can vary from S$0.50 to S$2.50, each payment being audible with a slight chirp.Currently, Singapore is looking into a second generation of ERP controlled by satellites.

Opposite | Total vehicle cost for a private car in Singapore

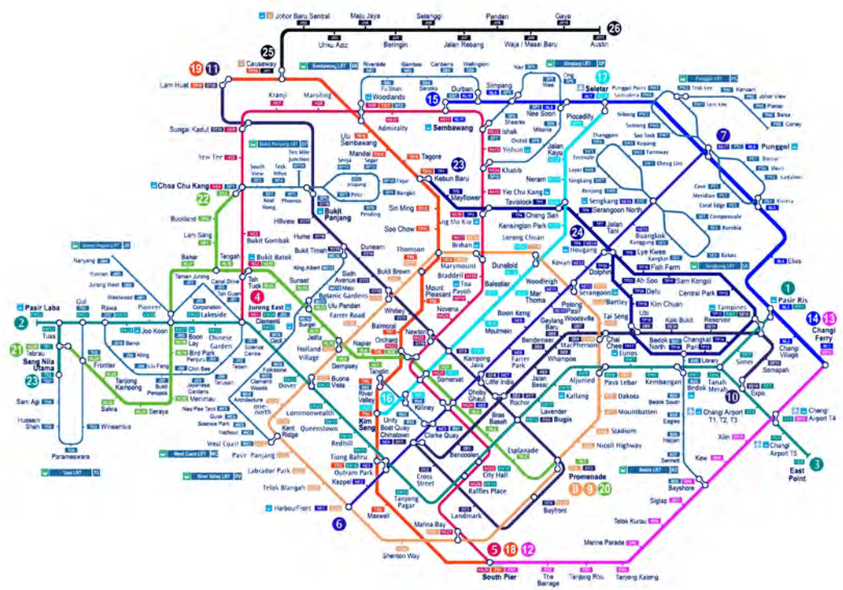
Below Right | Mode of Transportation to work in percent

ZHNG-CARCUSTOMIZATION





CURRENTMRT-NETWORK



EXPANSIONPRREDICTION2030

Opposite | Current MRT Network and Prediction of Future Development

Below Right | Mass Rapid Transport Train

Public Transportation

MRT is Singapore‘s rapid transit system, the foundation of its railway system spanning the entire city. With a total of 87 stations, it carries a daily average of 1.952 million. [52]

The MRT sructure is based on radial lines, providing direct links to the centre and orbital lines leading from within to places located outside the centre.[53] It‘s complemented by the regional Light Rail Transit (LRT) that links MRT stations with HDB complexes.[54]

While the rail lines have been constructed by the Land Transport Authority (LTA), a statutory board of the Government of Singapore, it‘s operating concessions are allocated to the profit-based corporations SMRT Corporation and SBS Transit - also running the bus and taxi services and ensuring a full integration of public transport facilities.

Singapore‘s government is strongly encouraging the use of public transport; to reduce the impact individual transport has on the environment and use of land while keeping up with the demand on personal mobility. The Mass Rapid Transport network is planned to expand significantly in the near future, two new lines already being currently build and doubling its current capacity of 148km to 278km by 2020.

The MRT was only based on its two main lines - North-South Line and East-West Line - for over 10 years, a third North-East Line was opened by 2003. However, all of these lines and even the ones currently under construction have all been planned in the long hand by the Land Transport Authority. It foresees the complete replacement of the Bus System by the MRT.[55] By 2020, the LTA expects a daily ridership ov over 4.6 million - more then twice the current capacity.[56]

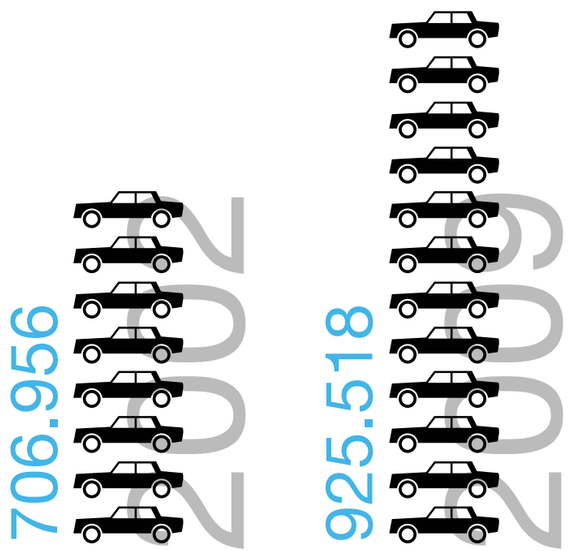
Opposite I Comparsion of the average speed on Singapore's highways and major roads between 2002 and 2009

Right Below I View out of a texi, stuck in Singapore's traffic

Left Below I Comparsion of registred cars in Singapore between 2002 and 2009

Average speed and registred cars

Despite restrictions and costly licensing the number of registered cars has increased steadily in Singapore for the past 10 years. Since 2002 over 200.000 new cars were registered, although the government has put much effort in regulation of private transport. On the one hand there's the Electronic Road Pricing System, introduced in 1998, it was the road toll collection system for purposes of congestion pricing, on the other hand there's the Certificate of Entitlement, introduced in 1990, that limits the car ownership and hence the number of vehicles on the country's roads. Nevertheless not only the number of cars has increased on Singapore's street, but also the traffic. Therefore the average speed on highways and on inner city roads dropped.



THE **FUTURE** OF TRANSPORTATION

Dubai recently opened its first Metro network in a bid to reduce the number of people using their cars, and cut carbon emissions. It raises the question that if government are so hell bent on citizens relinquishing their cars to save the environment, then what's the alternative? How else are people going to conveniently get around ?

IRT INDIVIDUAL RAPID TRANSIT

Driverless Pods are bringing up to four Passengers everywhere they want, being centrally controlled.

BOTTOM UP TRAINS SPEED TRANSIT

Monorail System for medium range distances in high speed above the ground with a view. Also used as cargo trains.

MAN POWERED MONORAIL MPM

Cycles can be used on Monorail tracks with the suport of speed and electricity by the train tracks..

ZEPPELIN MASS TRANSIT SYSTEM

Airships will be able to take Passengers for long and medium range flights, offering flight with the comfort of yesteryears.

E-SCOOTER PRIVATE & SHARED

With **Electromobility** being on the advance, the vehicle class of electrical driven scooters will explode in the years to come.

PERSONAL PODS ULTRA INDIVDUAL

The highly customizable Single Seater Pods are small and offer a wide range of mobility and affordable freedom.

CAR SHARING PEER TO PEER, NETWORK

Like music in online **exchange services** vehicles will soon be traded all around the city of Singapore in a masive network.

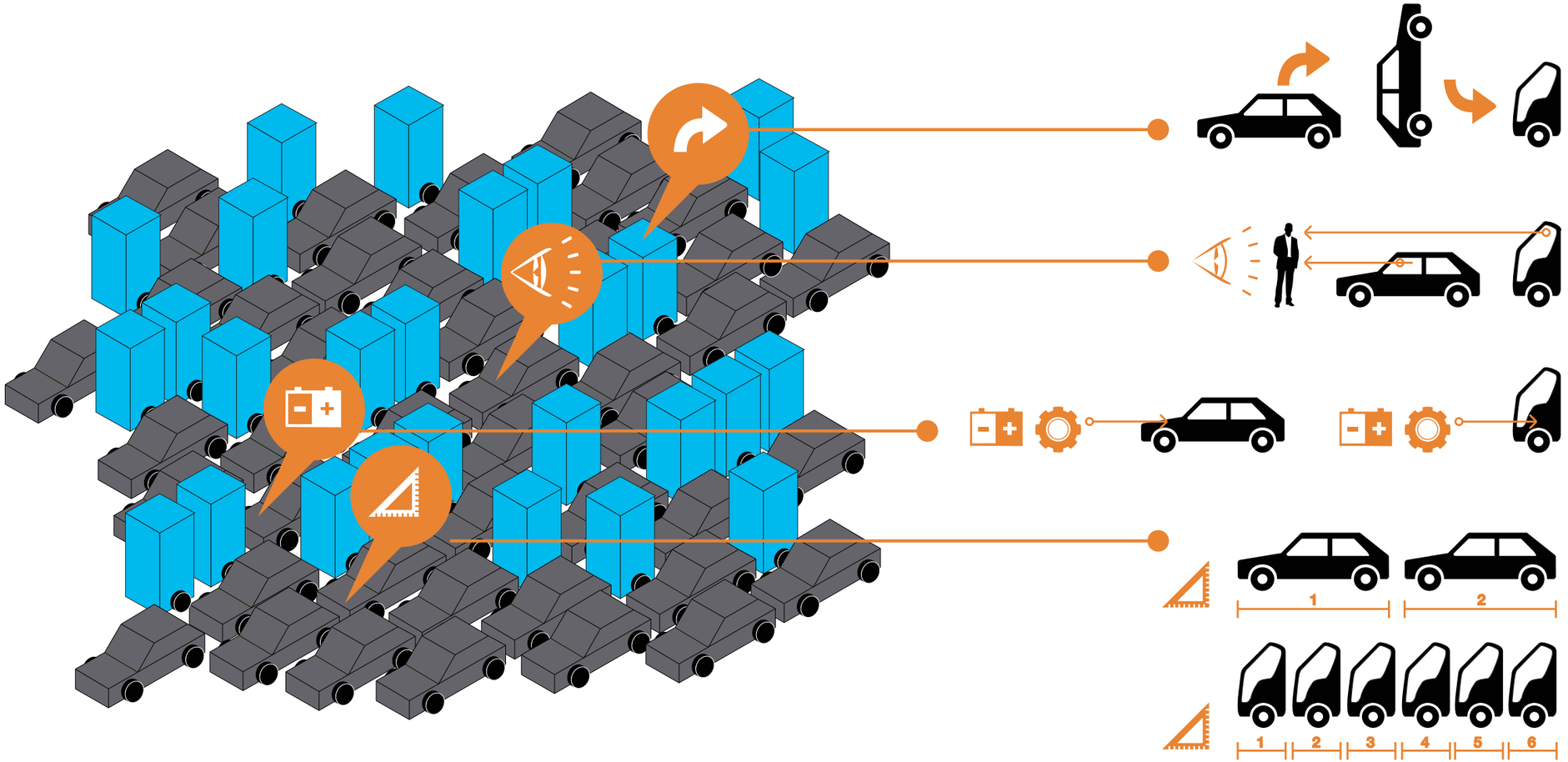
E TAXI NEW TYPE OF CAR

City Cabs will be a new efficient, ergonomic car form with space for many peaple and cargo with a eco-friendy motor.

Drafting Singapore‘s Future Mobility

Singapore‘s singularities and specific needs demand a radical approach for designing a new type of transportation. A market niche is established to guarantee the uniqueness of a future mobility product that fits to the custumor‘s and city‘s needs fulfilling the typological, infrastructural and climatiacal requirements of the megacity. The german design team conceptualizes a future mobility and infrastructure vision for this unique aequatorial megapolis, which is regarded as a guideline and influence on upcoming design teams in the TUM Create Vision for electromobility in megacities.

TRANSPORTATION**TYPOLOGY**



SHAPE

Convetional cars have since ever the same orientation, 4 wheels and a defined location for their engines. The future is thinking outside of the box and cars will change orientation to create a new type

PROSPECT

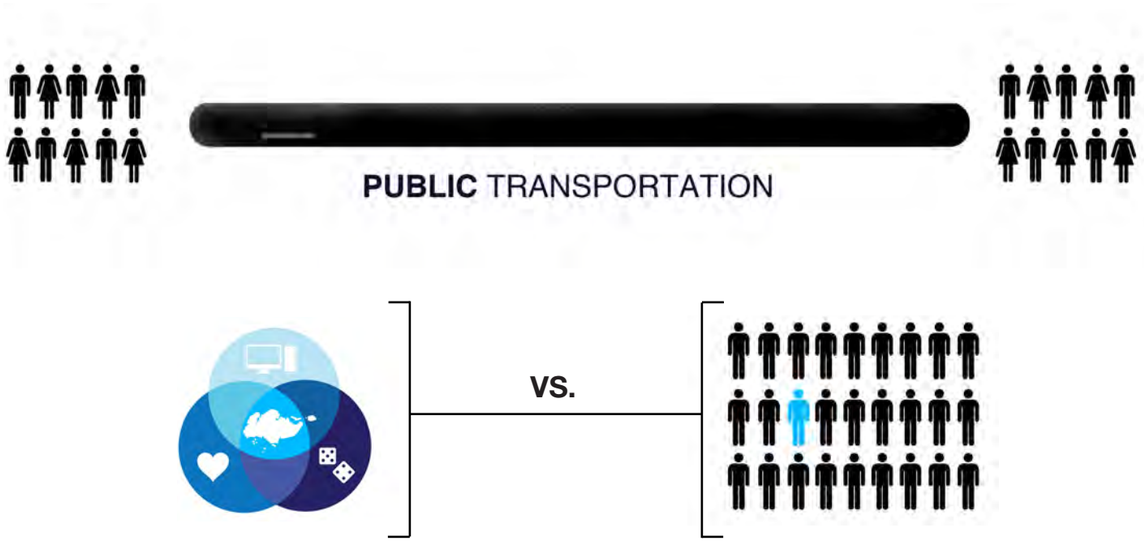
Because of the higher sitting position not only the driver has a better overview of other road users, but also other traffic participants, especially pedestrians do have a better prospect to the vehicles

ENGINE

Not only new kinds of engines are used, but also the location changes to coventional vehicles. New developed drives are located underneath the seat of the driver, therefore the front of the car will change

SPACE

The new shaped city vehicles doesn't require as much space as convetional cars, either it is in traffic, on roads or in parking lots.



Market Placement

Considering a completely planned through infrastructure plan for the future like the one done for Singapore, it‘s necessary to find a market niche still unfulfilled. With all the measures taken to reduce traffic, encourage public transport and bringing services and amenities closer to your home, what gap is opening in Singapore‘s mobility and what is the answer to bridge it?
Singapore‘s population is changing - both in wealth as well as in attitude. Besides all the convenience Singapore‘s clear regulations bring along, people are asking for independence and flexibility in their daily lives - private mobility being one of the key factors besides housing.
The wish for individualisation, customization and representation is seen in the handling of Singaporeans with their belongings, especially when it comes to mobility.
A highly flexible, personalized private mean of transportation, that is not a luxury good but a pool of vehicles, open and affordable for public use.
It shouldn‘t be a just another way of mobility existing alongside current development but integrate itself in the existing system, contributing to it‘s efficiency, profit from its benefits and vice versa. It needs to be dimensioned for the blurring typologies of street and pedestrian levels in Singapore‘s urban planning, for inner-city transportation with the possibility of short range trips.
Sustainability is achieved by means of reduction . in material, weight and energy consumption.

Opposite | Graphic depiction of public transportation in comparision with highly personalized private transportation; integrating the wish for individuality in Singapore‘s „Work Live Play“ future plan.

Below Right | Syd Mead‘s abstract vision of future mobility, an steadily interconnecting and -weaving network of different means of transportation.

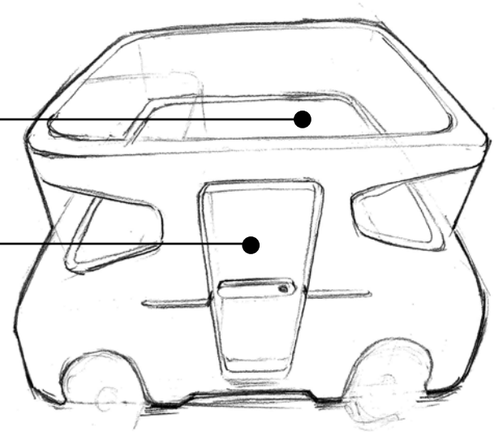
Sketching Phase

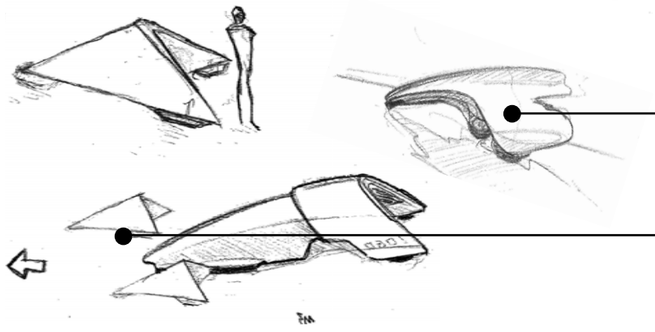
The sketch is the attempt of the representation of an idea, a design, a concept, a first overview. The term is used in different contexts. The sketch is the designer as a quick reminder and as a simple expression, in matters not on accuracy, but the striking illustration of an idea. All media are soft pencils, crayons or pencils or pens fiber. For several years computer programs like „Adobe Photoshop“ or „Autodesk Sketchbook Designer“ allow to designers to increase their workflow, while a good design is mostly based on a good sketch.

EXTERIORSKETCHING

Monobox Design for
Maximal Interior Volume

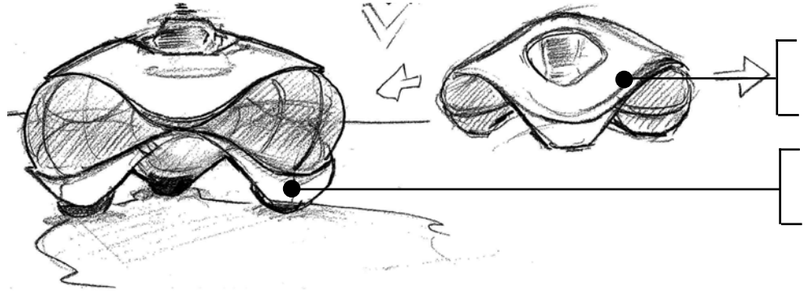
Sliding Door for Easy Access
influenced by House Doors





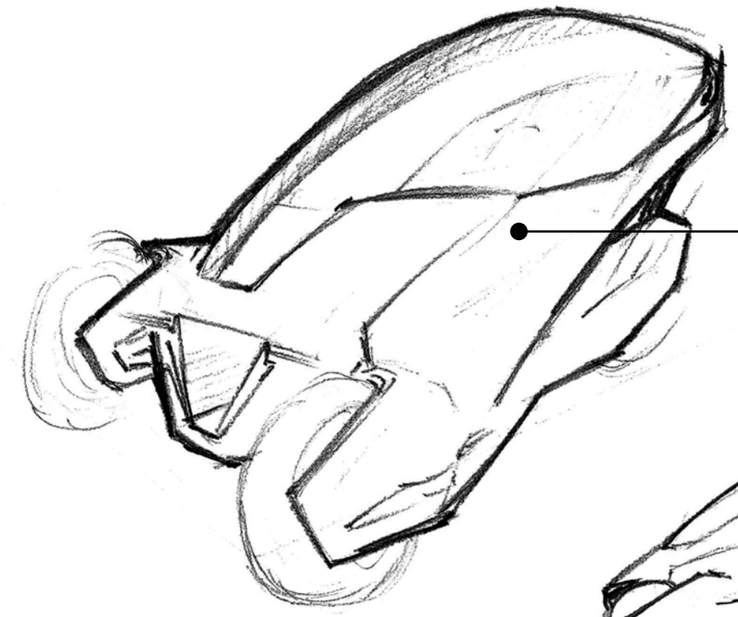
Pointed Dynamic Orientation

Stackable Design through repeated
Pattern



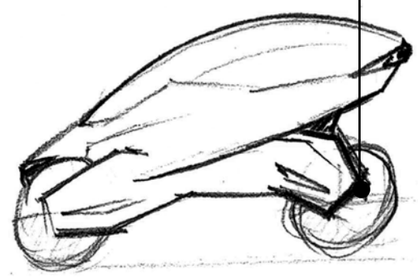
Shapechanging Interior
through different Constellations

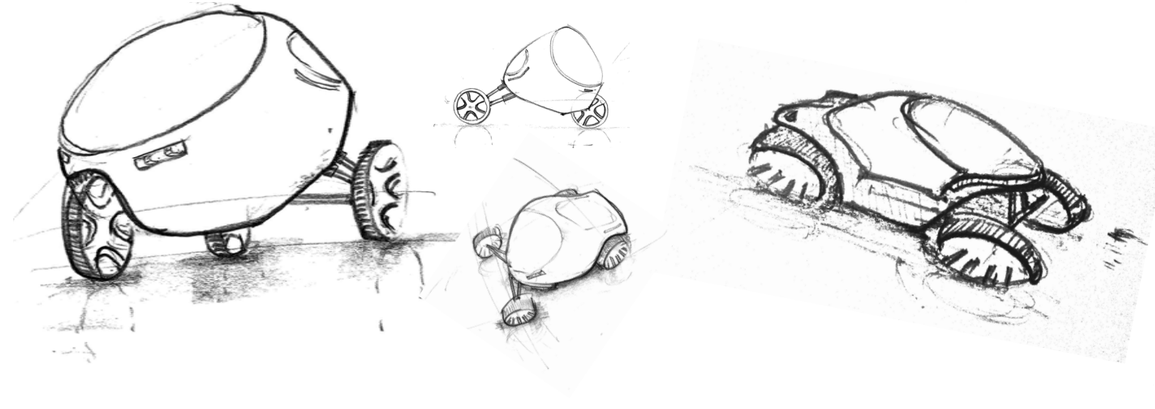
Omnidirectional Orientation
& Stackable Parts



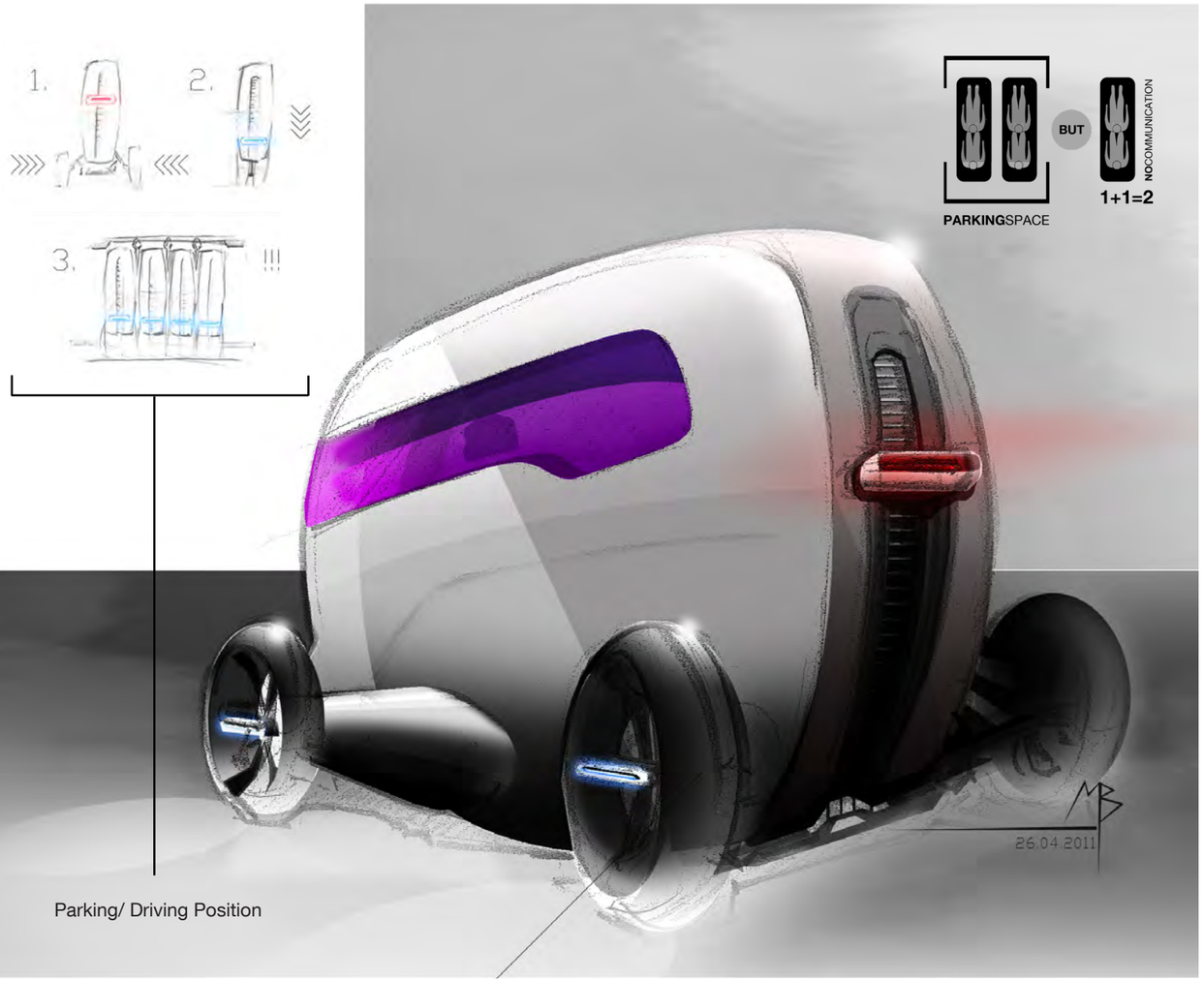
Reversed Trike Configuration
for Aerodynamik Drop Shape

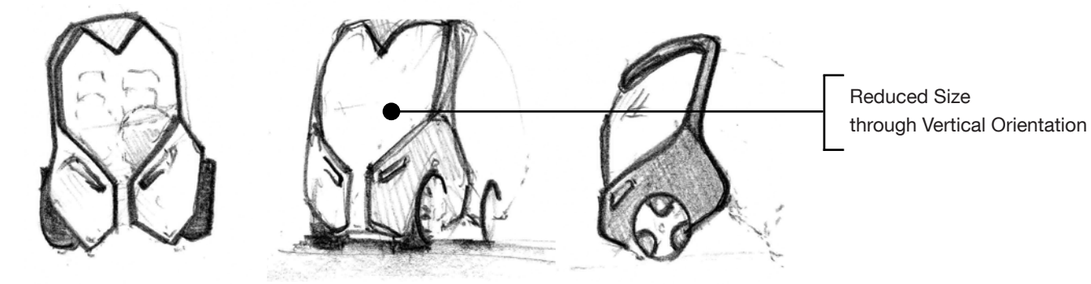
Smallest Possible
Stable Arrangement

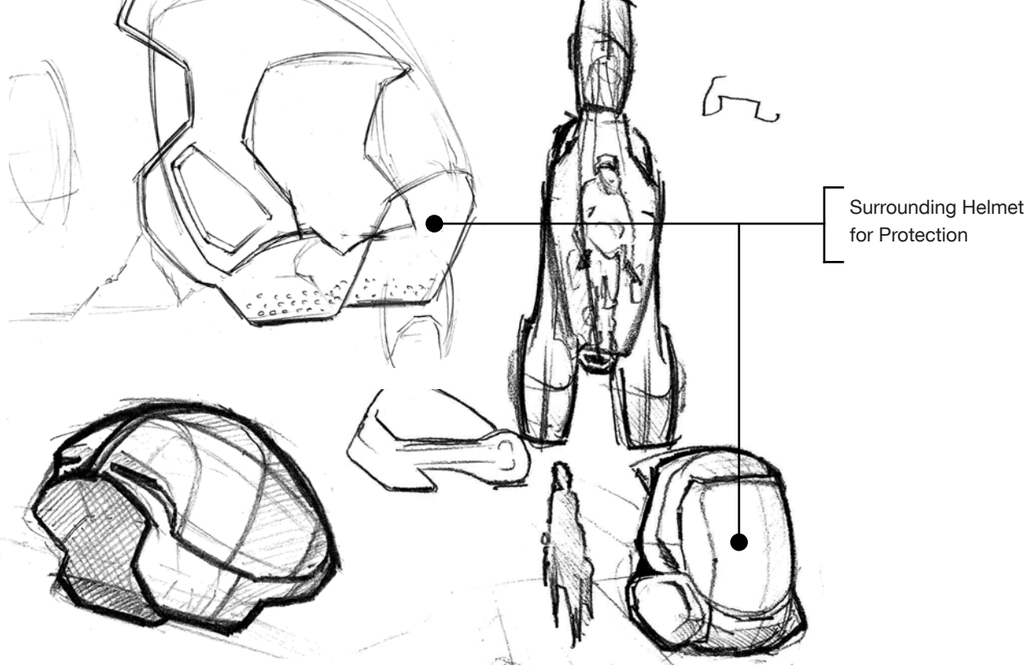




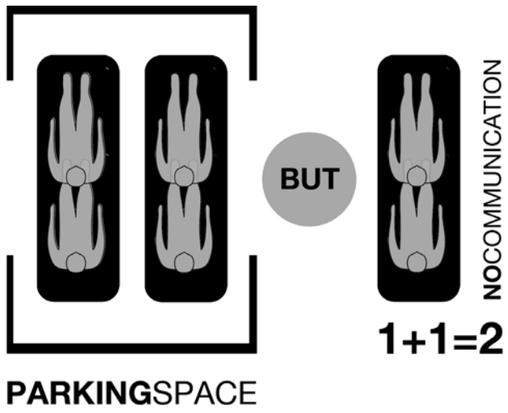
EXTERIORSKETCHING

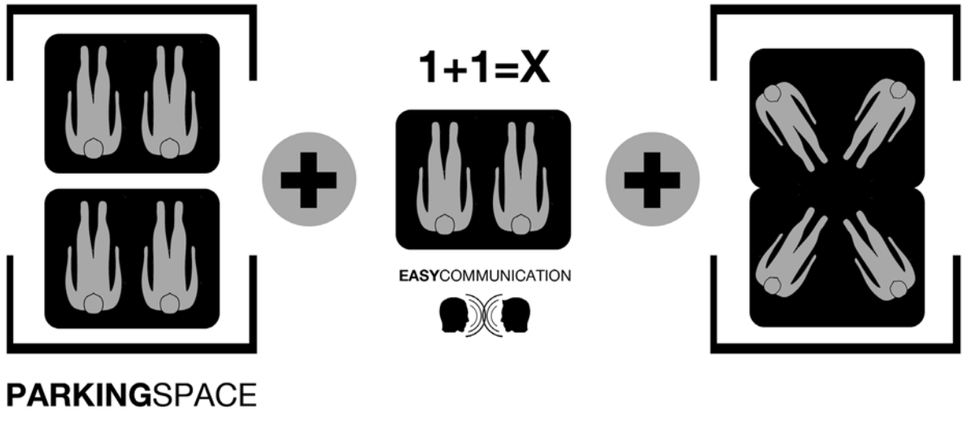






INTERIORCONCEPT

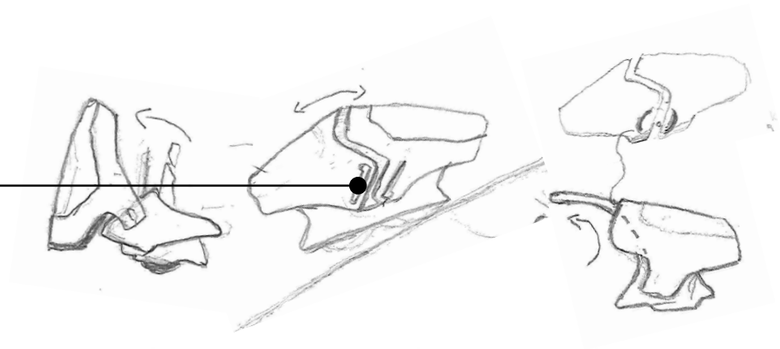




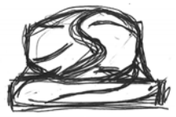
In self-experiments with 1:1 mock-ups different seat configurations were tested. The goal was to unite the two two-person units with both the two and the four man constellation generating an attractive interior space. The driver should be clearly recognizable as such because of its pungent role and function, sitting separately. The rest of the cabin is arrangeable in an X-constellation, resulting in the optimum space the by means of communication and exchange.

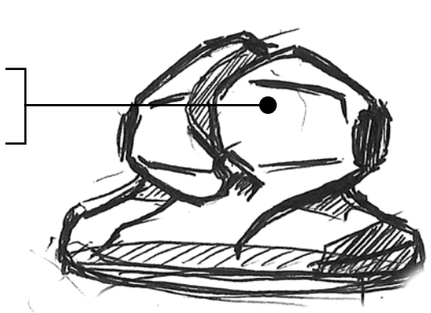
EXTERIORSKETCHING

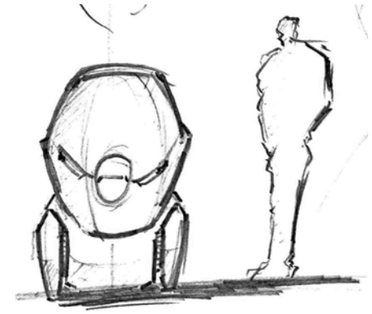
Shared Pivot at both
Parts for Opening



Embracing Gesture
of two becoming one



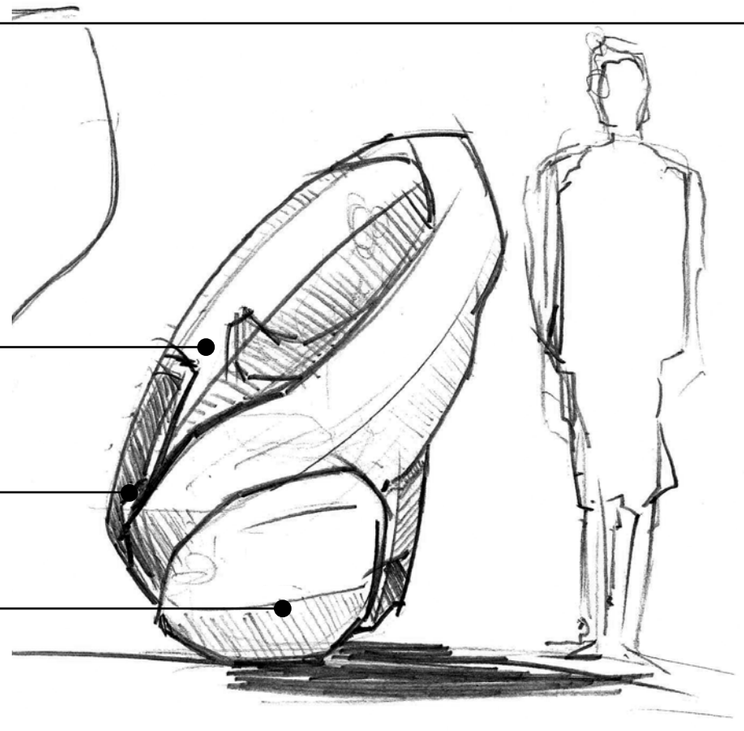


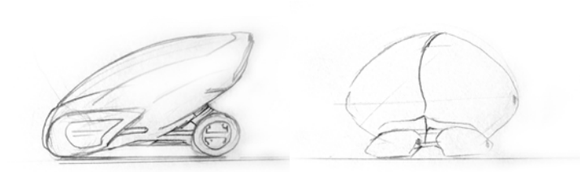


Wide opened Front
Visor for Prospective

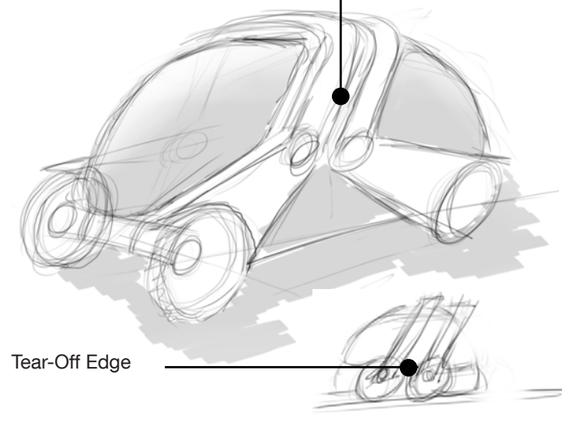
Opening Mechanism
for Front Access

Railmounted Wheels
to keep Balance

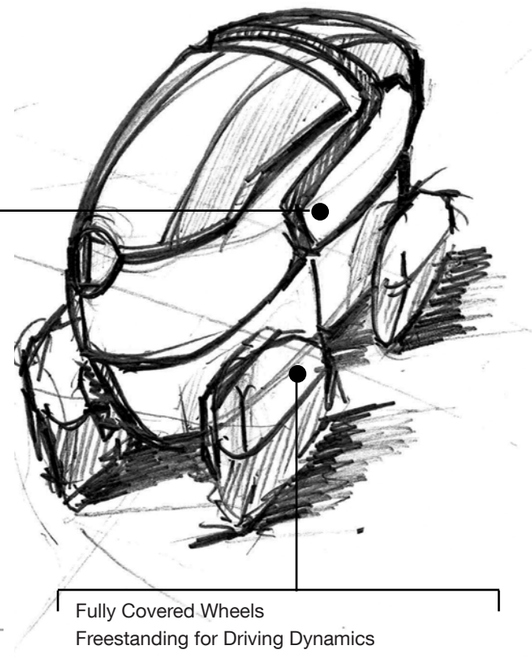




Back to Back Connection

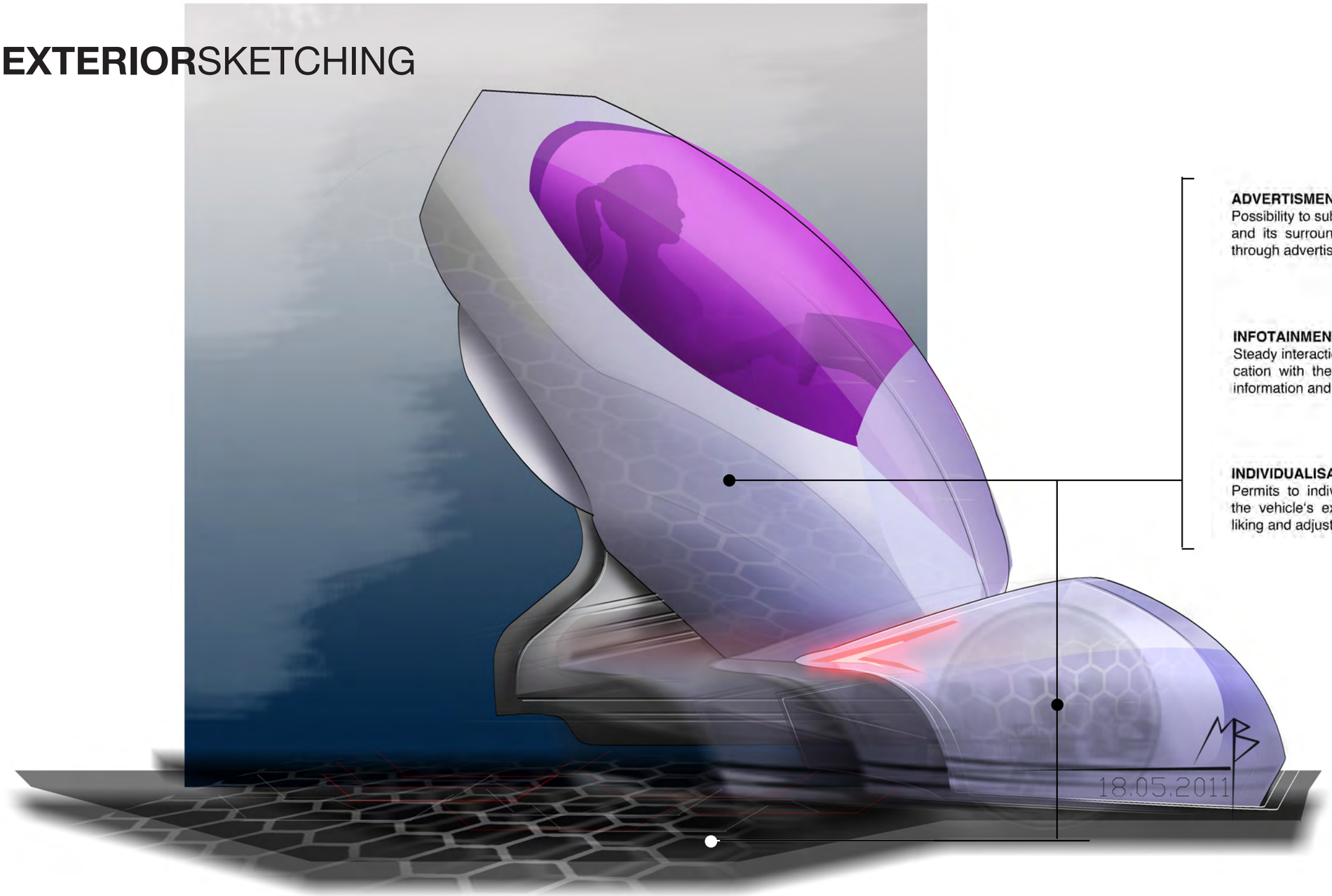


Tear-Off Edge



Fully Covered Wheels
Freestanding for Driving Dynamics

EXTERIORSKETCHING

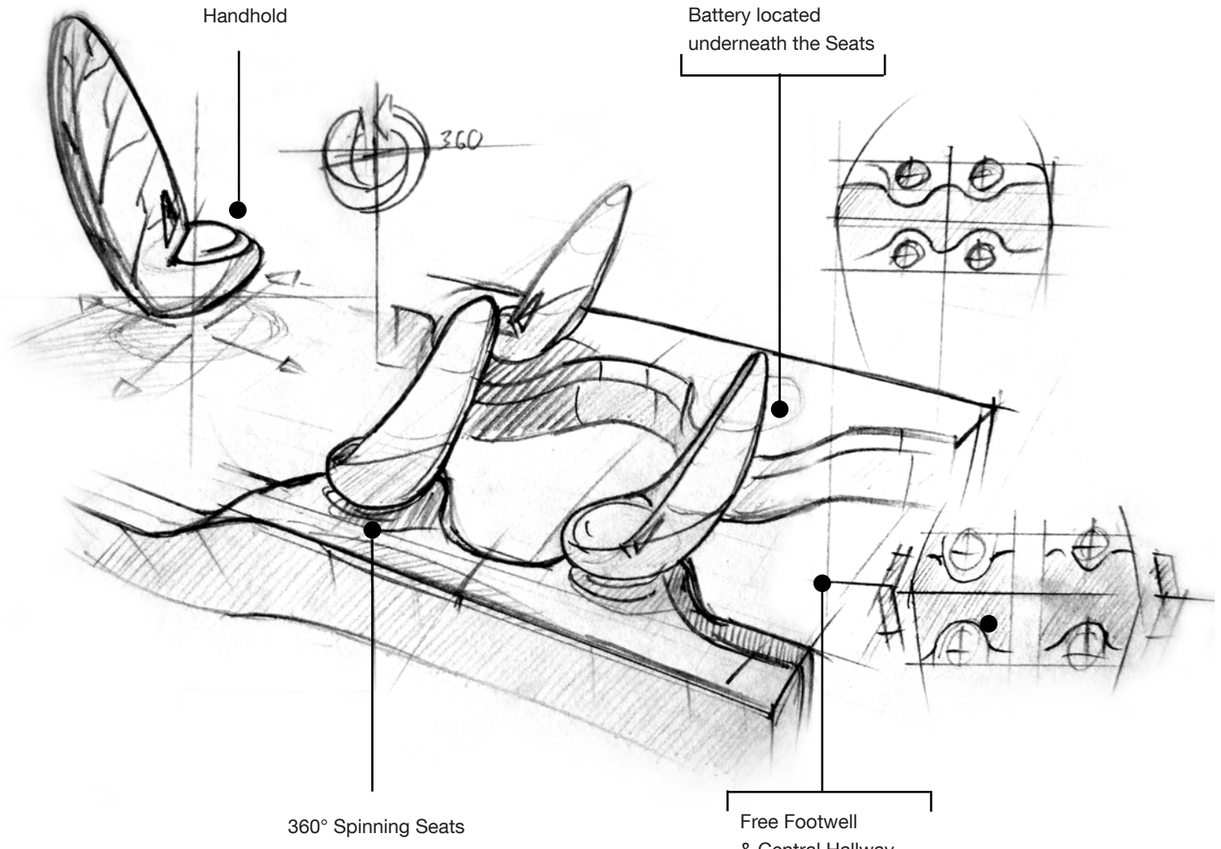


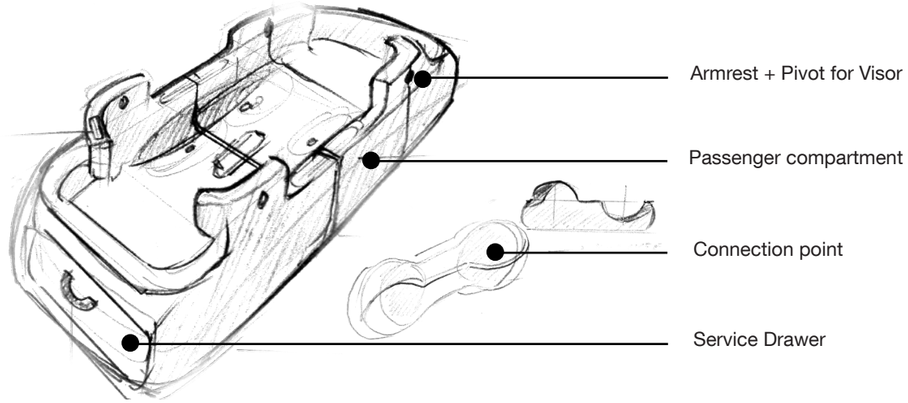
ADVERTISMENT
Possibility to subsidize the vehicle and its surrounding infrastructure through advertisement sponsoring.

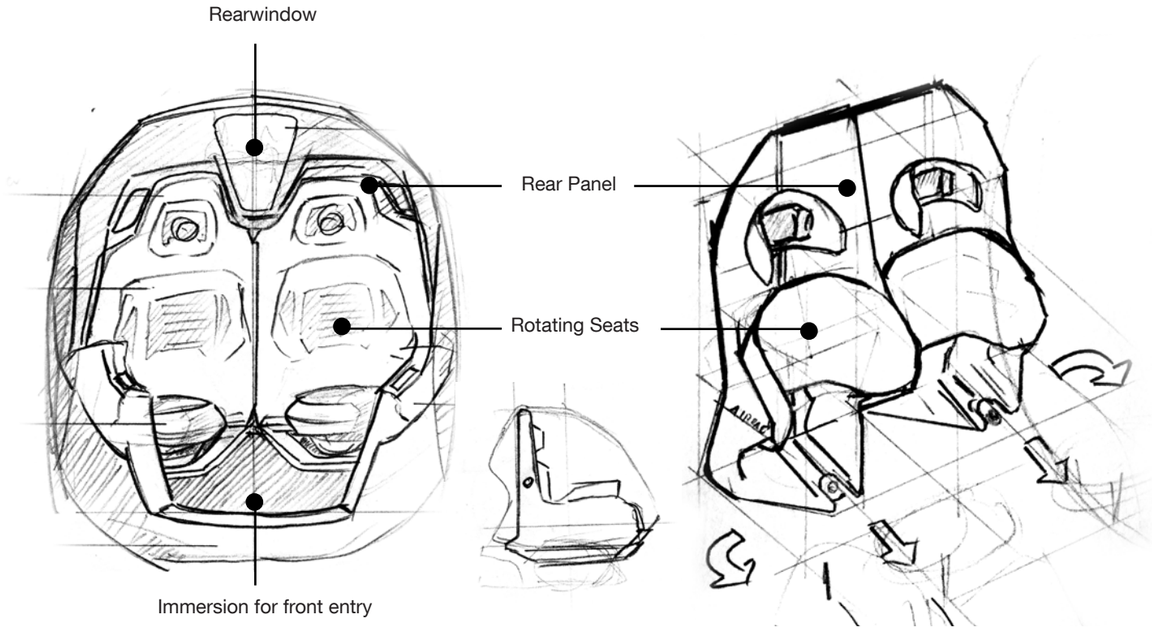
INFOTAINMENT
Steady interaction and communication with the surrounding via information and efficient routing.

INDIVIDUALISATION
Permits to individually customize the vehicle's exter ior to personal liking and adjust to chaning moods.

INTERIOR**SKETCHING**







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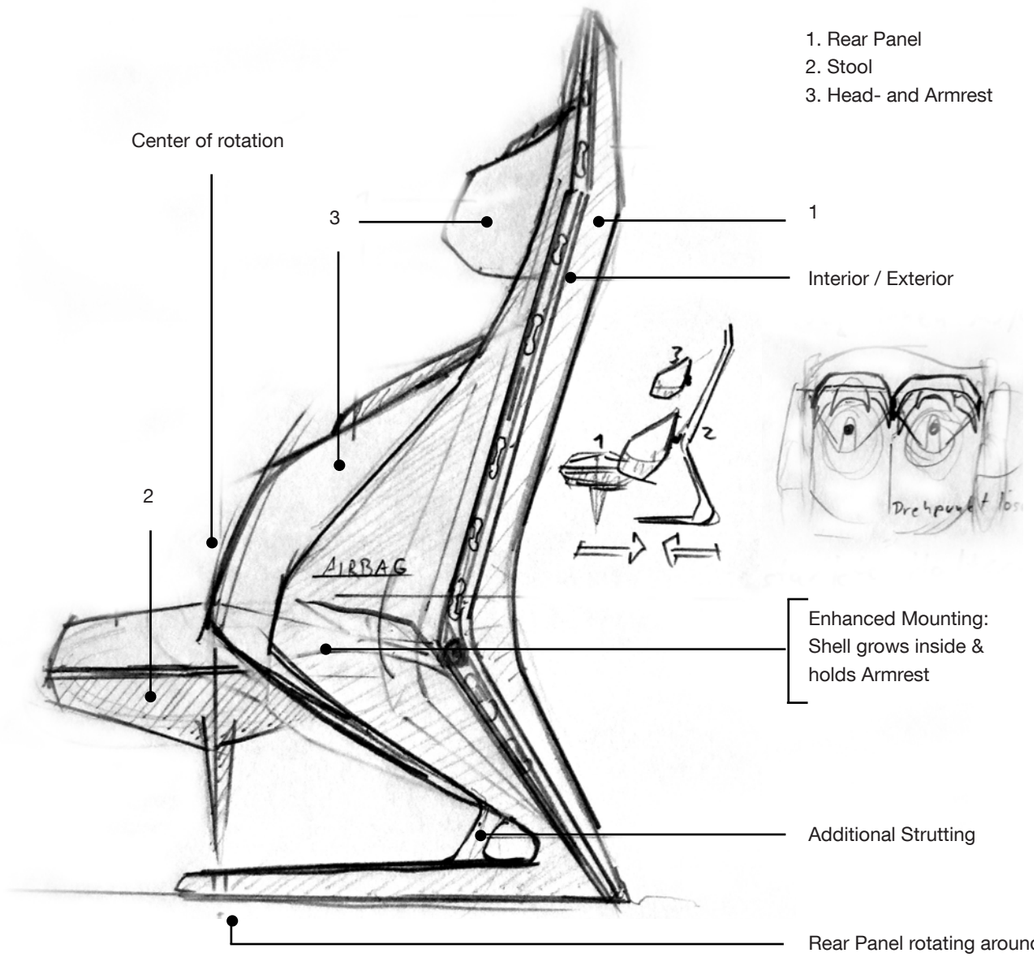

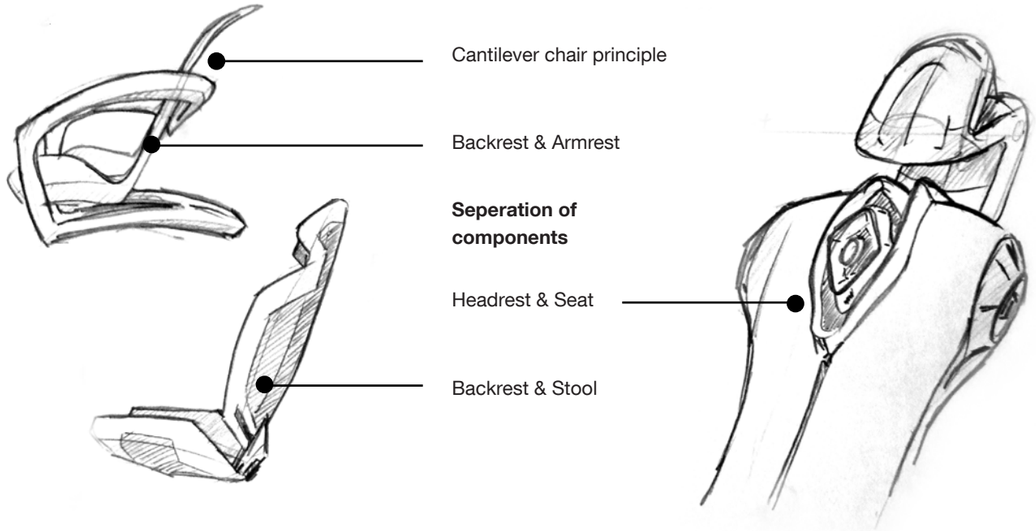

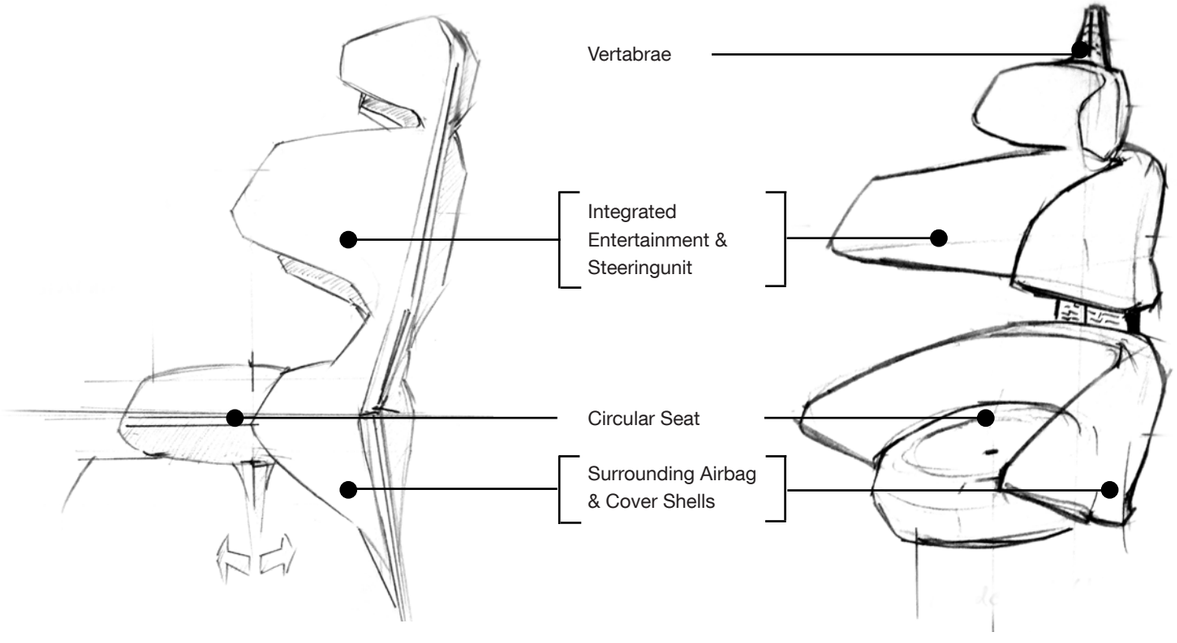

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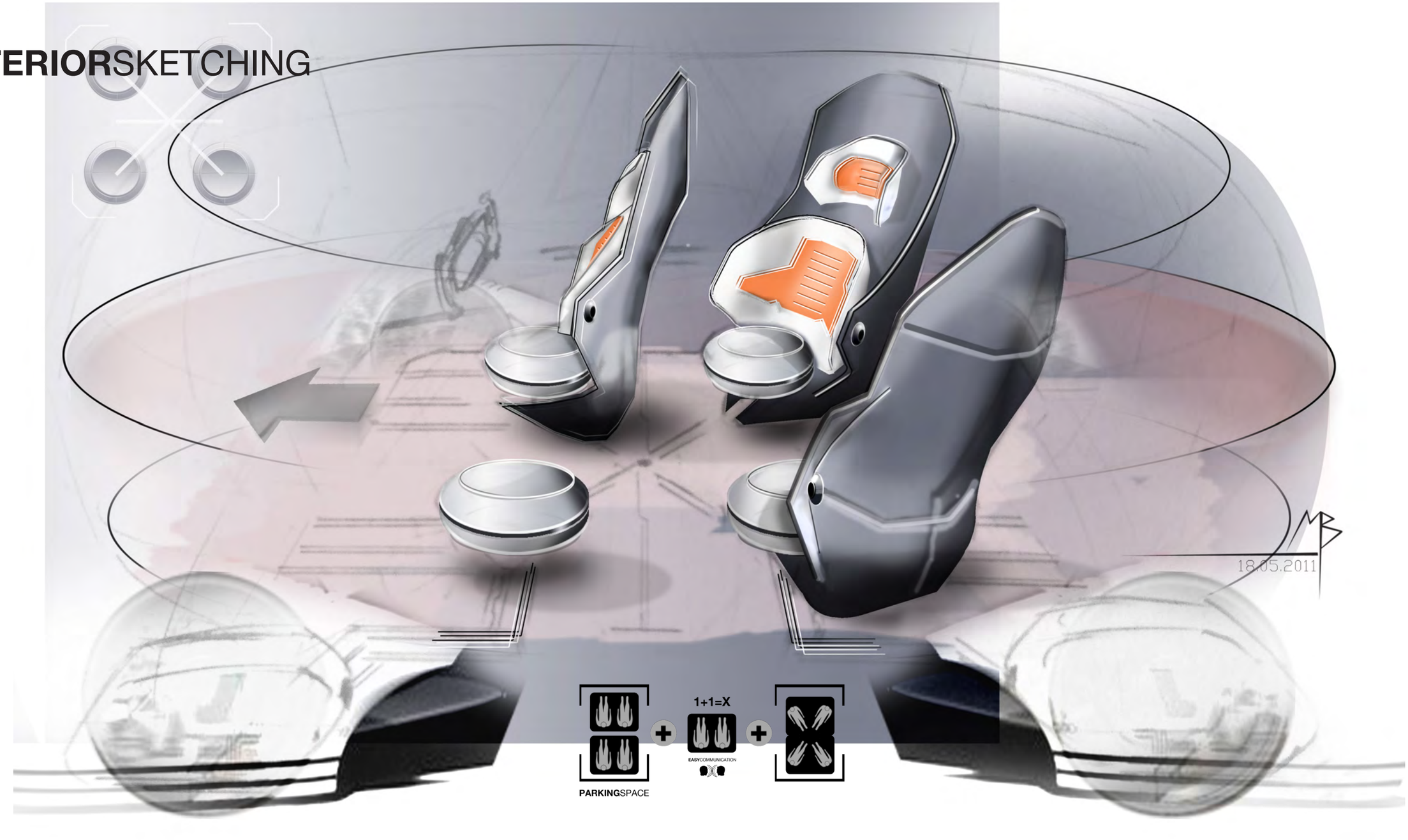
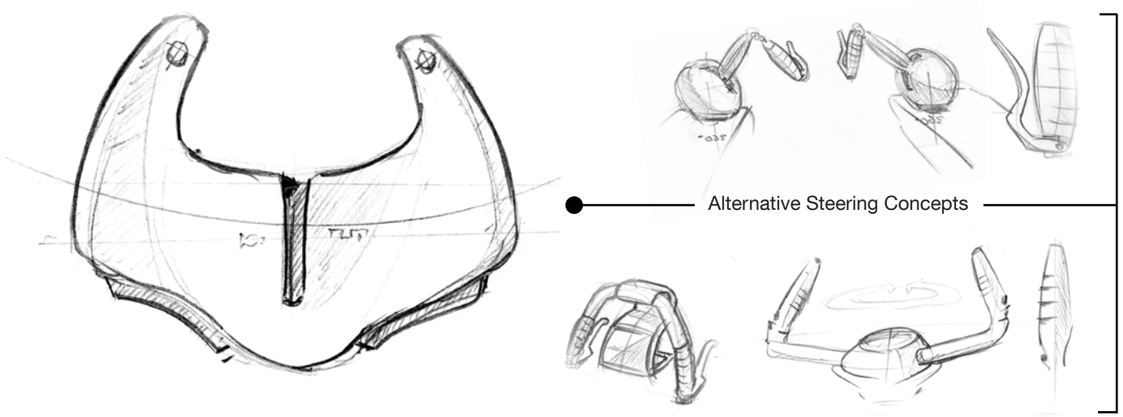
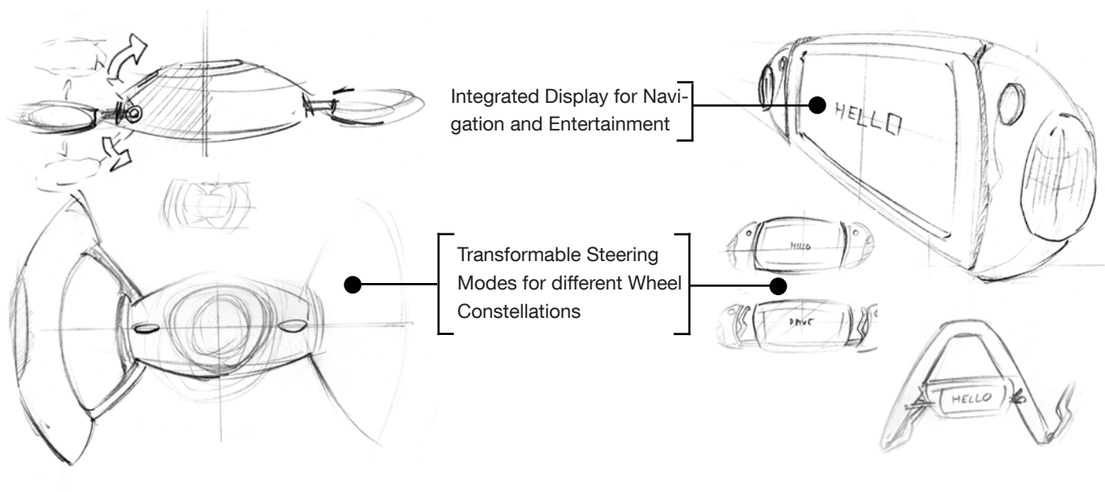
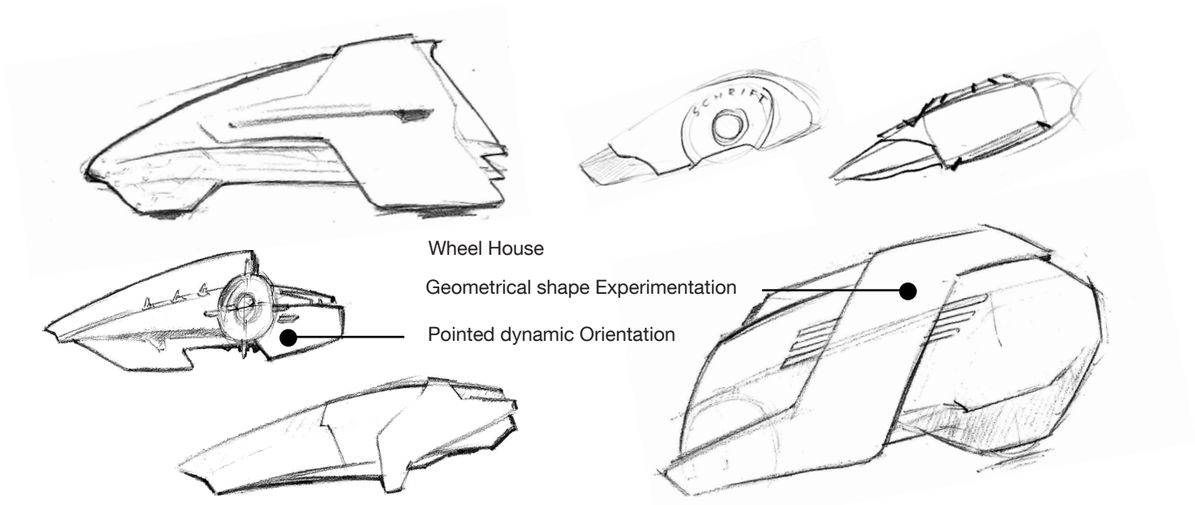
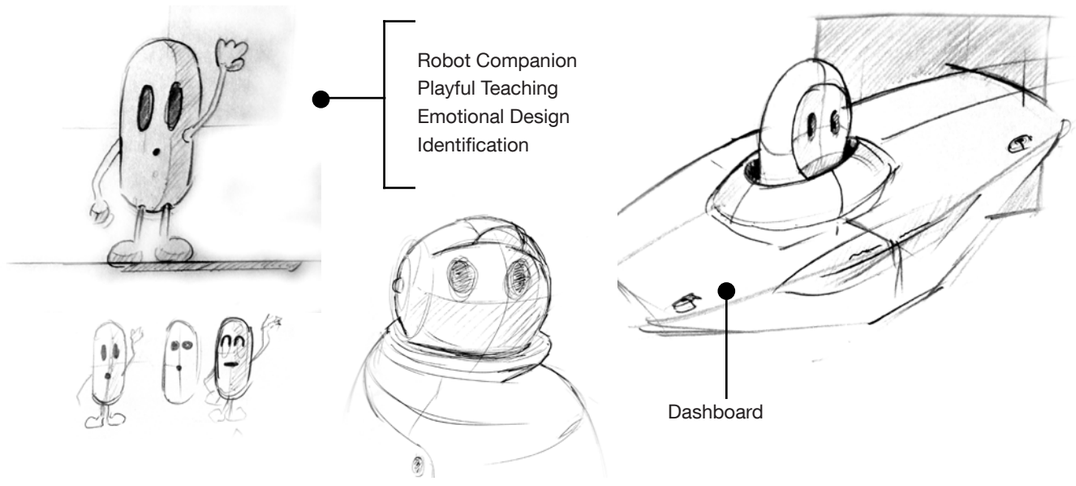


DETAILSKETCHING

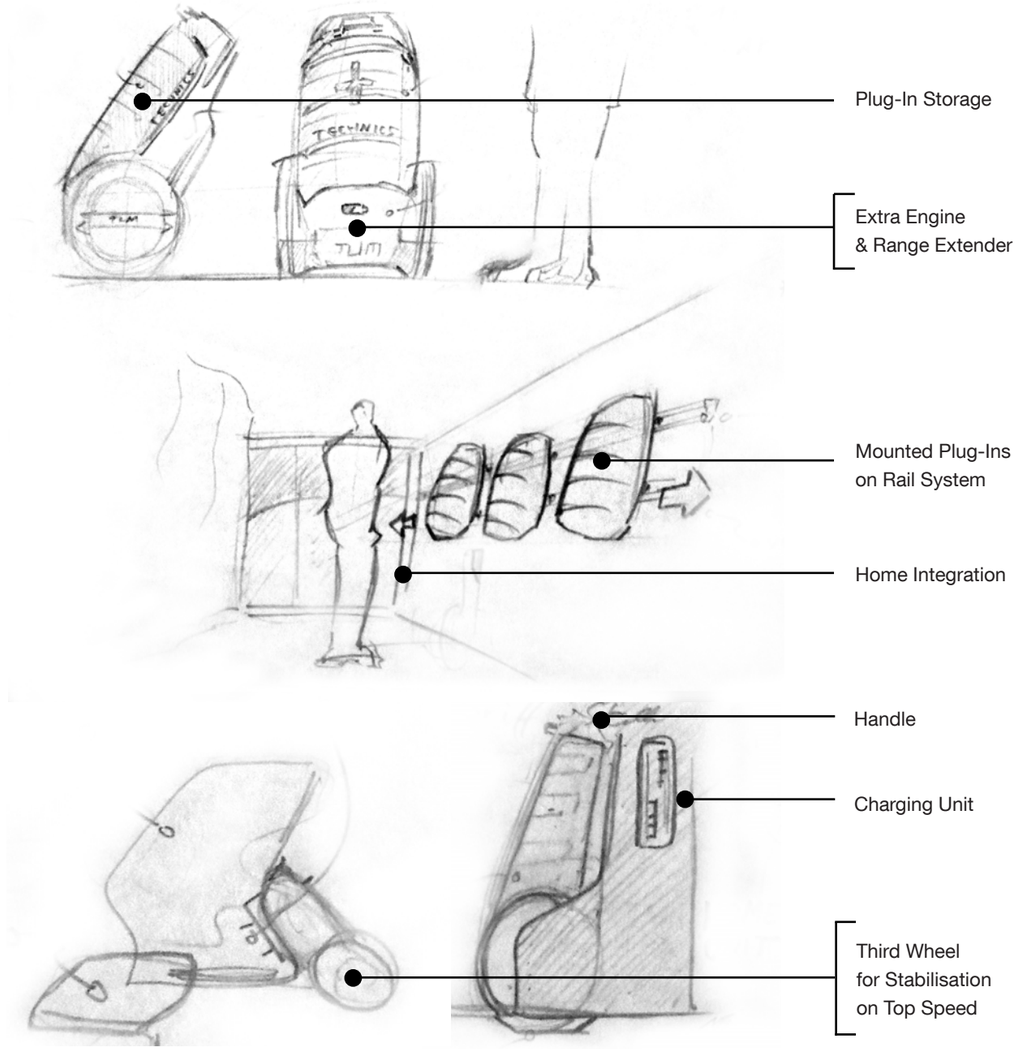


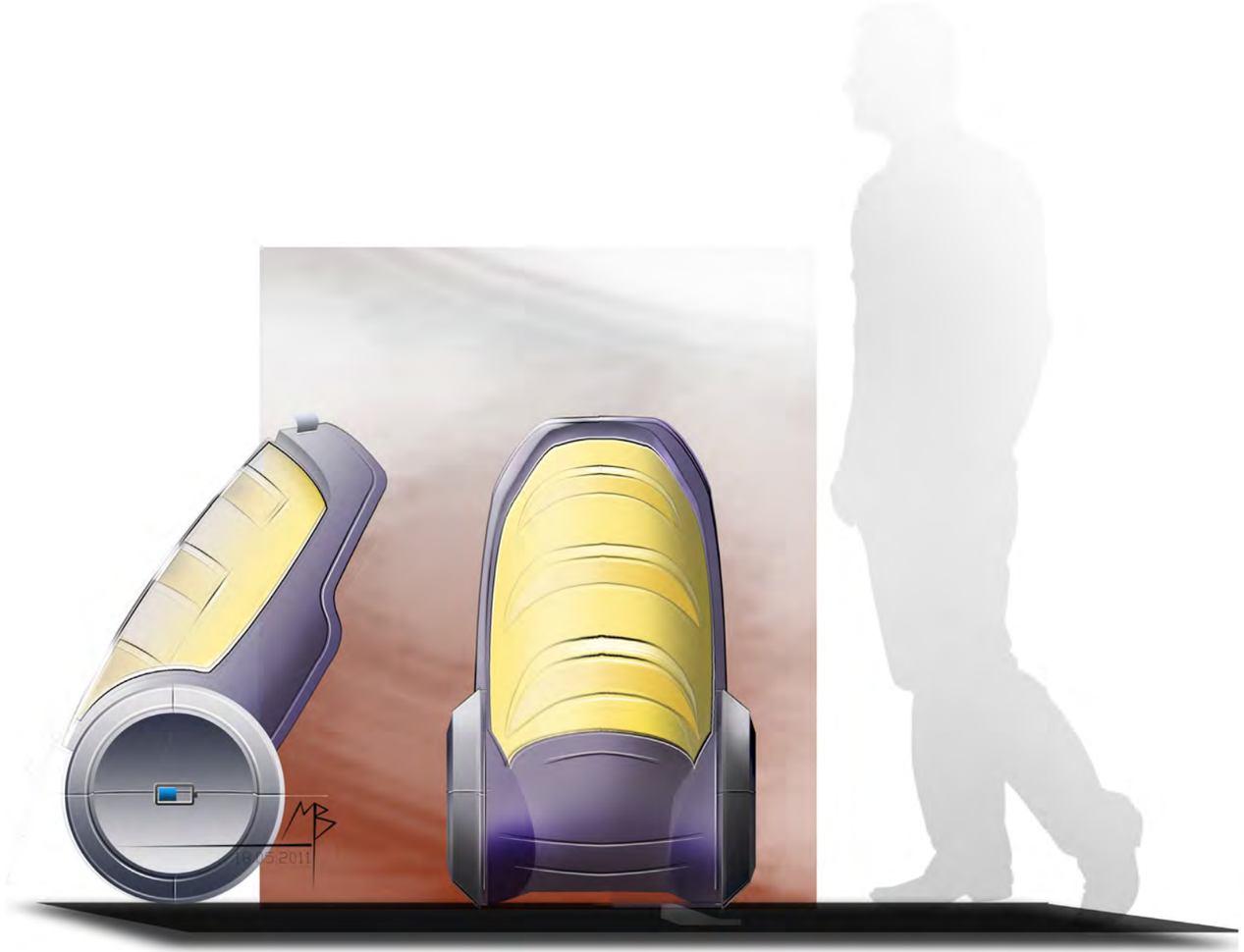






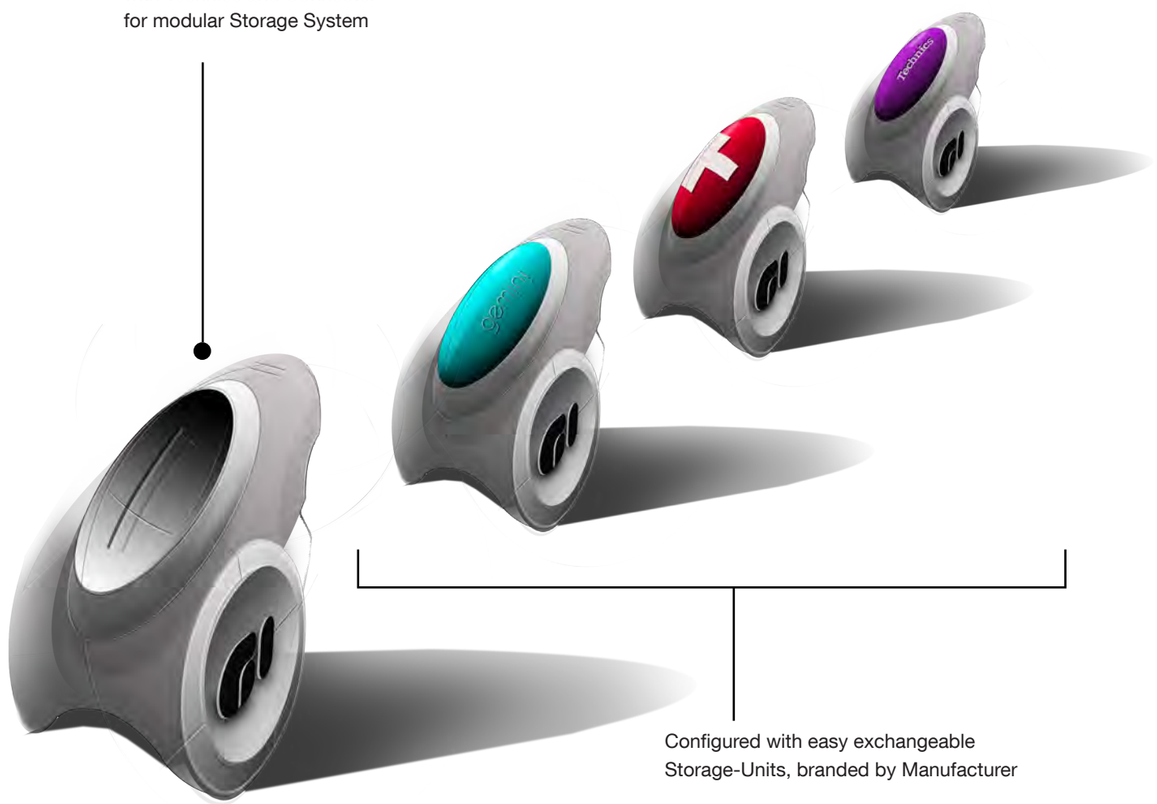
PLUGINSKETCHING





PLUGIN**SKETCHING**

Plug-In Basis Unit
with Technics and Connector
for modular Storage System



Configured with easy exchangeable
Storage-Units, branded by Manufacturer

PLUGINSKETCHING

FINALDRAWING

Branding

By the change of target groups in style groups and the emergence of more and more niche markets for products, it is increasingly difficult to establish themselves in the market. Thus brands seen on a longer period become more and more important. The future car can only survive with a qualified brand identity. This must be represented in all media, publishing, and of course on the product itself. A uniform design language has to be found for a sustainable draft.

Corporate Identity

The corporate personality represents the totality of the characteristics of a company. The concept of CI is based on the idea that companies are perceived as individuals and can act similarly as such. In this respect, companies are granted a quasi-human personality. It is regarded as the responsibility of corporate communications to help the company achieve such an identity. The identity of a person arises for the observers to speak normally from the optical appearance and the manner and to act. If we consider a company as a personal agent to some extent, it can convey its identity to a strategy consistent action, communicating and visual appearance. If everything fits together and produces the complementary parts of a unified whole, a stable perception of an actor is created with a specific character: the corporate identity. Typically, the CI‘s corporate philosophy, the mission statement, the terminology, the policy directives, the name, logo and other visual cues, possibly acoustic characters (such as a corporate anthem) as well as all other distinctive and unique features and in particular the special promise of the company‘s brand. The corporate identity consists of corporate design, corporate communication, corporate behavior, Corporate Philosophy, Corporate Culture and Corporate Language.

Corporate Design

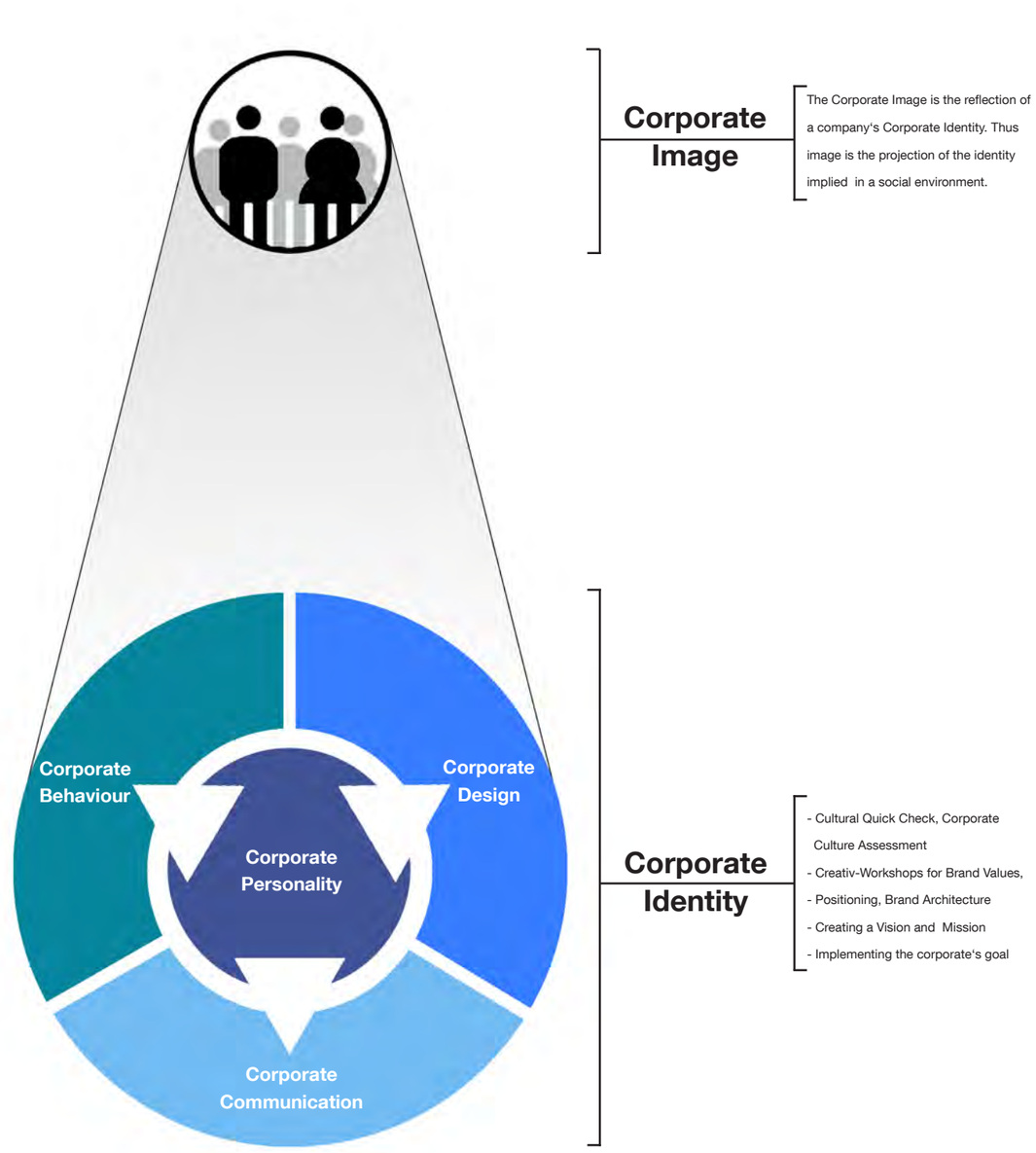
In Corporate Design (CD), describes the visual identity of a company. Corporate design is applied in the design of logos, workwear, forms, online presentations, corporate architecture, premises, color and so on. Corporate design is further expanded dealing with increasingly more sensible features such as the acoustic performance or the olfactory presence.

Corporate Communication

The Corporate Communication (CC) covers the entire communication of a specific company - both internally and externally. Corporate Communications is applicable in all advertising, public relations but also in internal corporate communication.

Corporate Behaviour

The Corporate Behaviour (CB) describes the behavior towards the public and the stakeholders. Corporate behavior, among other things, is evident in financial management (monetary), personnel management, in real tone and in response to criticism. Corporate behavior is the description of behavior of a company from outside. There is often a discrepancy between self-views and guidelines of a company and the real actions.



gemini

Gemini

Gemini, latin for ‚Twin', is the third astrological sign of the Zodiac, originating from the Gemini constellation. Formed by two parallel lines descending from it's main brightest stars, Castor and Pollux, the constellation represents a pair of twins holding hands.[57] Chinese astronomy divides the two configurations into the Vermillion bird of the South (Nán Fang Zhu Què) and the White Tiger of the West (Xi Fang Bái Hu).[58] According to Greek mythology, the twins Castor and Pollux, collectively known as the Dioscuri, are the two sons of Zeus. While Pollux has been born immortal as a god, Castor has been mortal from birth. After the death of Castor, Pollux asked his father Zeus to permit him to share his immortality, so the two brothers could stay forever in eternity - being transformed into the Gemini constellation.[59]

Astrology sees the sign of Gemini as positive and extrovert - it's main characteristic being it's versatility.[60]
The image of Gemini represents the main principles of the vehicle concept: a unit formed out of two identical parts, two becoming one and forming something new.
This theme is drawn through different design elements, both in interior and exterior - the arrangement on the roof is modelled after the symbol of the Gemini zodiac, generating its counterpart mirrored in the heavenward part of the vehicle.
The seating arrangement in two passenger configuration is evoking the safety and comfort of the ultrasound view of growing twins. While both units are identical when viewed seperated on their own, they both generate a new entity as soon as they're placed together - more than just the sum of its parts they benefit from the exact likeness of their doppelgänger.

LA /lah, la/ int.
[Gemini's main unit]

LAGI /lah-gee, lagi/ a.
[additional functionality]

The birth of a new langauge: Singlish

As Singapore‘s population comes with a great diversity of native languages - counting four official languages in total, the country always had to face the problem of common communication. Therefore, almost every Singaporean is supposed to be speaking two languages: his first mothertongue and Singaporean English as official interlanguage.
Several government campaigns are both encouraging the use of proper English as well as the conserving of the various first languages, especially Mandarin since China‘s economic boom.
Singapore English is rooted in the times of colonial rule over Singapore in the 19th century. Due to the clash of different cultures and ethnical backgrounds, Singaporean English quickly began to develop its own identity after Singapore‘s declaration of independance in 1965.[61]
Vocabulary and Grammar from English, Malay, Hokkien, Teochew, Cantonese, Tamil, Bengali and Punjabi lead to what is known as ‚Singlish‘ today - a variation on its English origin, mixed with a southern Chinese syntax.[62] For people not used to the unique sound of Singlish it takes some concentration to understand every nuance of the language - uneccessary prepositions and pronouns are left out, phrases shortened and pronounciation and intonation shifted in favor of an unconventional, fast and fluent stakkato.

LA /lah, la/ int.

One of the most omnipresent words - or rather sounds - in the singlish slang is the syllable ‚La‘.
‚La‘ equates to the phonetic of an exclamation mark in Singlish, an alteration of its malay origin. It is used as a particle suffixed to emphasize any word or sentence. It may even be used as a sort of interjection, as in „there you are!“. Steadily heard in everyday conversations, it‘s like the constant companion of every statement that is meant to be underlined, accentuated and called into immediate attention.[63]
As such a expressive commentary, a punch-line on future transportation, ‚La‘ forms the basic unit of Gemini, merging into eponymous twins, ‚La La‘ when docked together - it‘s entity being reflected in the doubled exclamation marks of Gemini.

LAGI /lah-gee, lagi/ a.

Extended with the morpheme ‚Gi‘ - the smallest component of a word or other linguistic unit that has semantic meaning when combined - ‚La‘ forms ‚LaGi‘, a Malay term for „additional“ and „more“, expressing superiority and a gain in quality.[64] Like it‘s origin of name, the simple addition of just one handy plugin named Gi - respectively only two letters - changes so much of the meaning and scale of the Gemini La. Another meaning of words and another typology of vehicle.

Final Visualisation

Following the sketching, conceptualising and analysis phase the final elaboration of the project begun. Interior and exterior concepts were created as well as an implementation and marketing strategy.

gemini

Gemini‘s main unit ‚LA‘, an extremely reduced personal capsule for 2 persons is setting minimum space- and weight requirements. It is strongly focusing on individual transport within the short range of the city center, where the lines of street levels and pedestrian zones are blurring due to high-density, vertical urbanism and slowed down, road pricing controlled traffic. By adding the modular-structured add-on ‚GI‘, Gemini shifts its typology - offering a wider range of usage through improved stabilisation, a performance boost and an included range extender. Its plug-in based system of flexible storage permits the possibility of personalization and customization.
Combining two ‚LA‘ units back to back, Gemini can be used as a micro car for families. The interior rearranges itself to form a new space of communication and exchange between the passengers and a plus of storage, resulting in a flexible configuration that provides more then the sum of its parts.

COREDATA

GeminiLa

2

40 km/h

50 km

2

2

The new GEMINI LA has direct access to inner city areas, which can‘t be reached with convetional cars, i.e pedestrian areas or similar traffic calmed districts. Especially the unmodified two seater concept is designated for these areas, because of its minimum size and low speed. The main purposes for their use is either getting to work and shopping malls.

GeminiLaLa

4

90 km/h

90 km

4

4

The LALA represents a new and flexible era of family vehicles, because of the two independent two seaters, which are merged and therefore increase the total range. On the hand it can be used for bigger shopping, vacation or other family purposes on the other hand it also works as the separated two seater version, the so-called LA. Because of its size, it doesn‘t require much space either on the road nor in parking lots.

GeminiLaGi

2

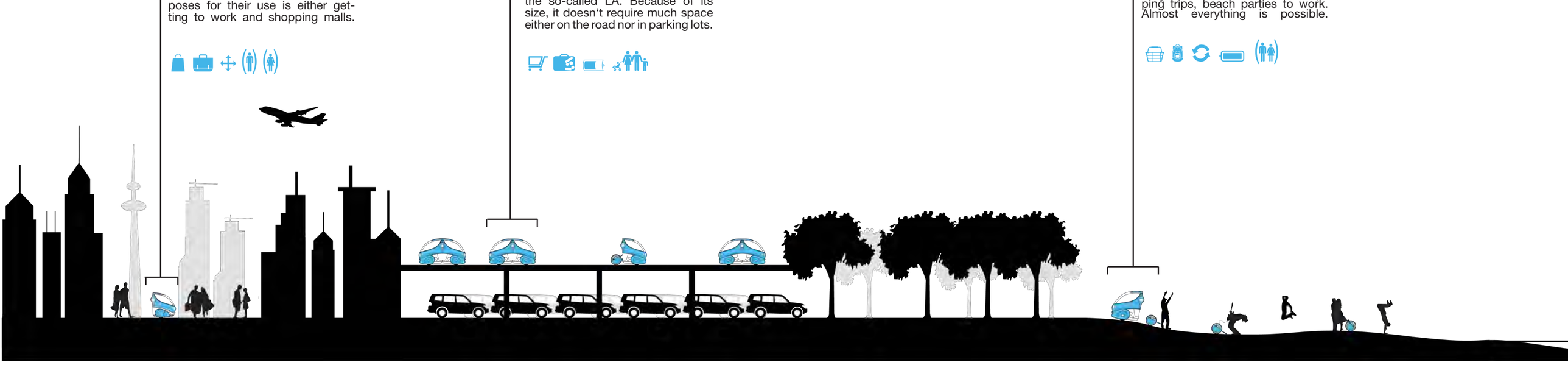
110 km/h

90 km

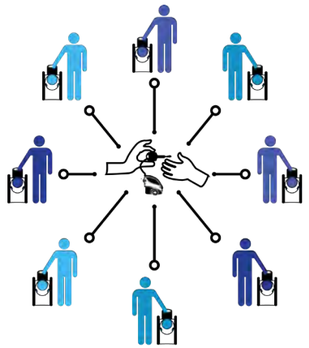
3

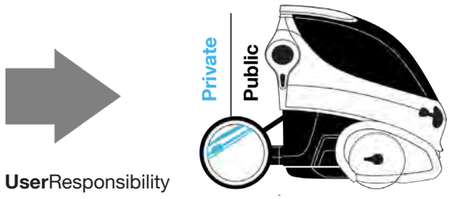
3

A new rolemodel for flexible city vehicles is the modified two seater, the GEMINI LAGI, with the additional third wheel package. Not only the range is increased, but also the functinalty of the two seater is enriched remarkable. It is furnished with a new multifunctional add-on, which can be used regarding to its purpose. The range is wide. From small shopping trips, beach parties to work. Almost everything is possible.



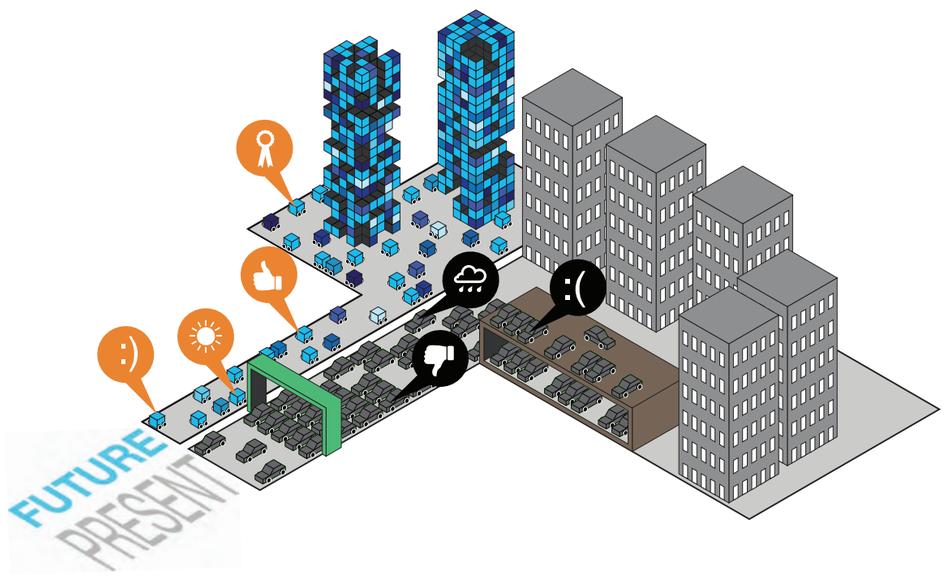
CARSHARING





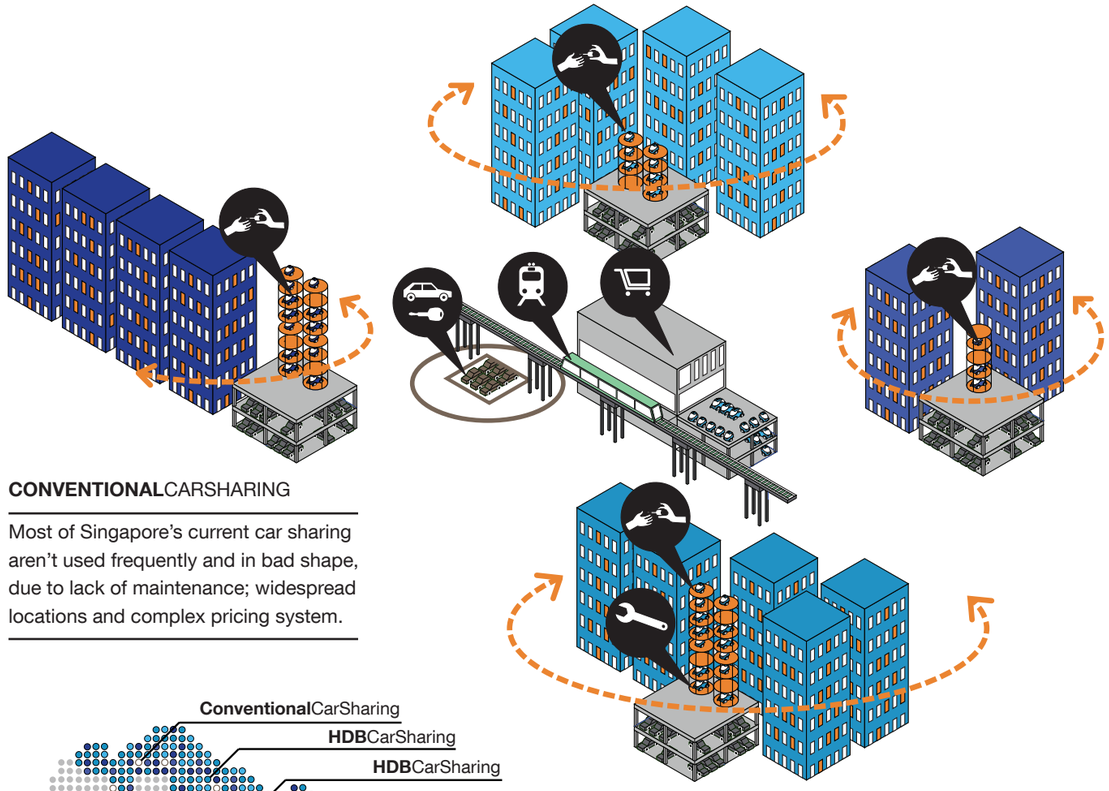
UserResponsibility

The integration of personal belongings into a shared vehicle by splitting it into a public - the main unit - and private - the third wheel - part neglects the psychological barrier oh sharing on of the most private objects of a Singaporean.



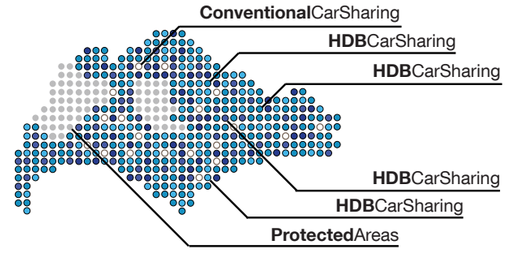
HDBCARSHARING

Both the manufacturer and the Housing and Development Board take an active role in providing and supervisioning the Gemini car sharing. The HDB, already responsible for housing and amenities in a Singaporean's live ensures the seamless integration of a shared vehicle in everyday routine.



CONVENTIONALCARSHARING

Most of Singapore's current car sharing aren't used frequently and in bad shape, due to lack of maintenance; widespread locations and complex pricing system.



NEWCLASSIFICATION

Exterior

The Gemini‘s body is laid out to inhabit a maximum of interior volume within smallest use of space. The wide open front allows a maximum connection of the user to hies or her surrounding environment.

EXTERIORFUNCTIONS

SunScreen & RainShield

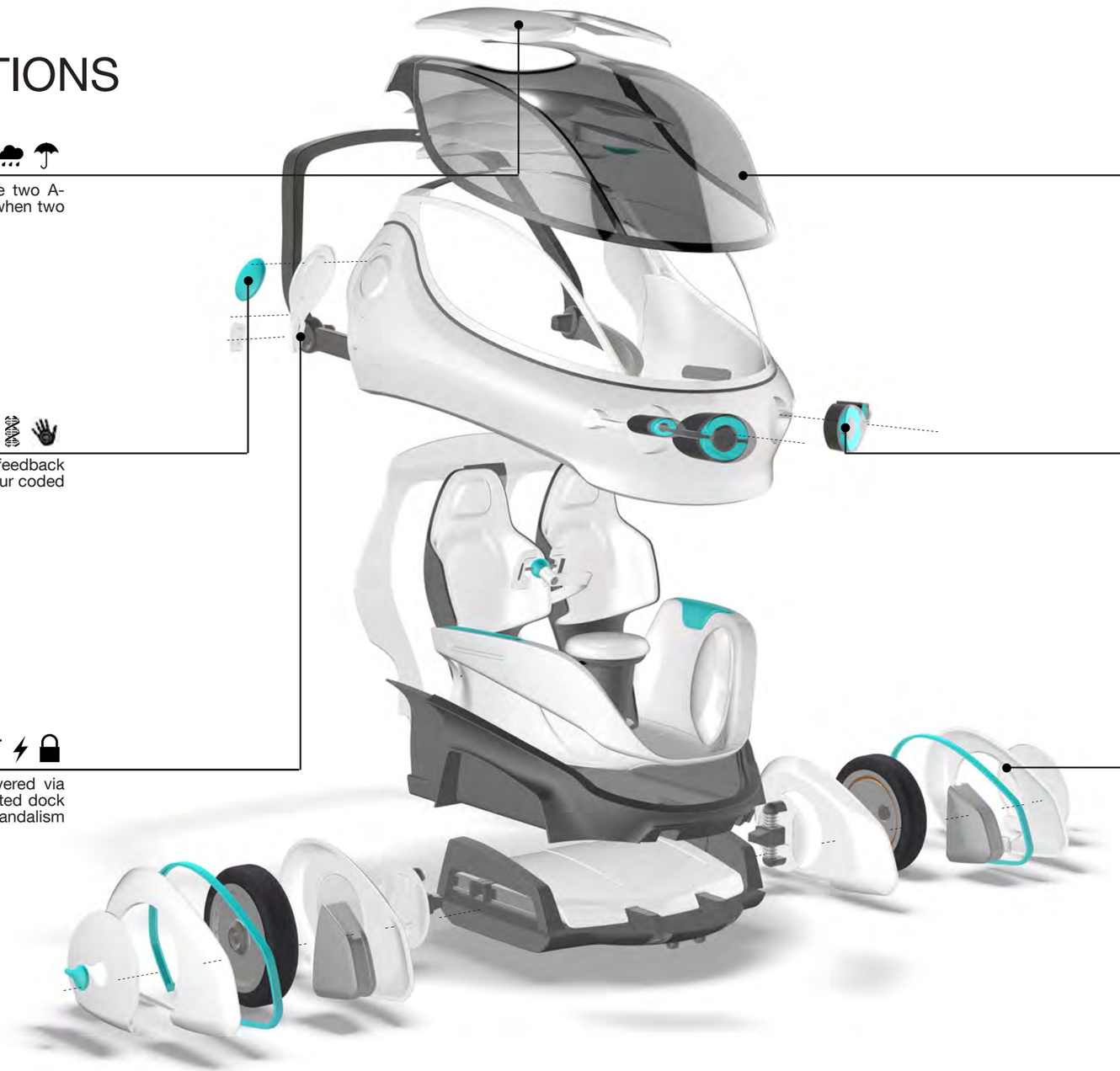
Retracting rain shield, mounted between the two A-pillars, forming a rain shield for the opening when two units are combined.

User Interface

Door opening touch interface with tangible feedback through soft silky gel-body and backlight colour coded media facade.

Quick Charge

Power supply dock with lockable front, covered via push-pull admission for easy access. Integrated dock connector, locking the charger to prevent vandalism and theft.



Exchangable Clip-Ons

The lightweight construction of the hood allows a quick change. Third party suppliers can provide different styles for different tastes.

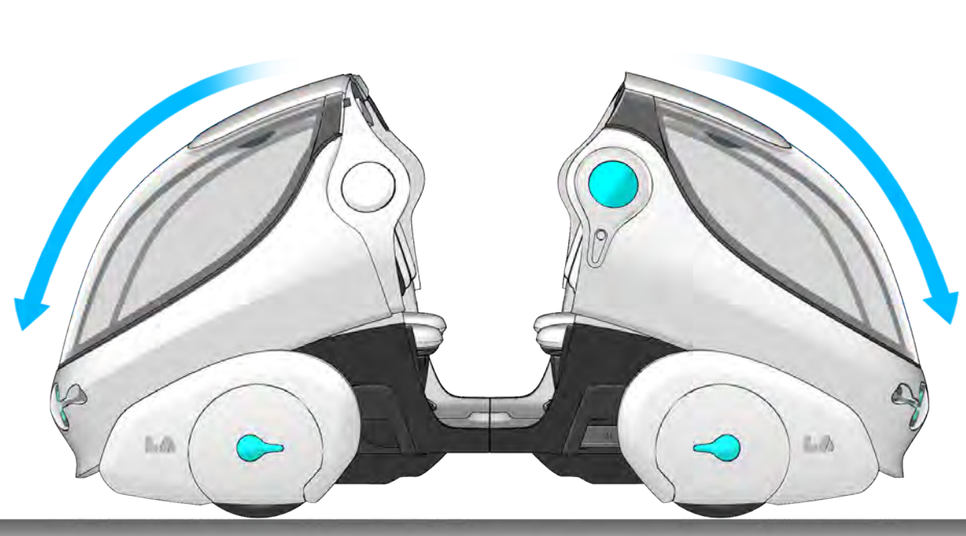
Front Lights

Emotional design through variable, stylised physiognomy based on the asian emoji expressions for feedback between the vehicle and both the passengers as well as its environment.

Wheel House Integration

Relocatable wheel house mounted on sled with integrated protection system for travelling with higher speeds.

OPENINGMECHANISM



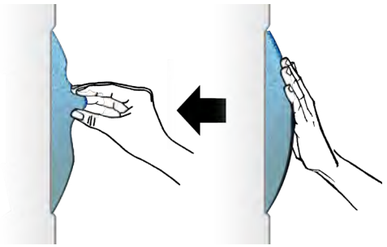
GeminiLa

Wide open front entrance for both passengers. Easy and intuitive plugin unit access and installation at the rear panels / seats.

GeminiLaLa

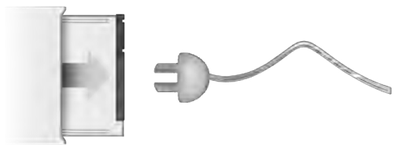
Common, barrier free entry from both sides of the vehicle for comfortable seating access, central for all passengers.

EXTERIORDETAILS



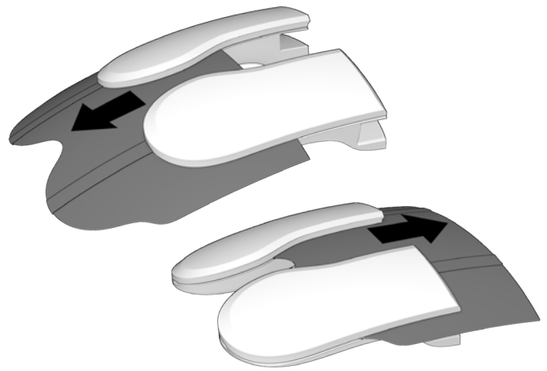
UserInterface

Door opening touch interface with tangible feedback through soft silky gel-body and backlight colour coded media facade.



QuickCharge

Power supply dock, with lockable front, covered via push-pull admission for easy access. Integrated dock connector, locking the charger to prevent vandalism and theft.



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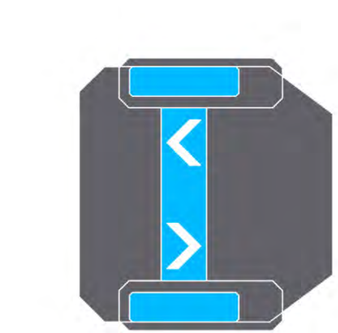
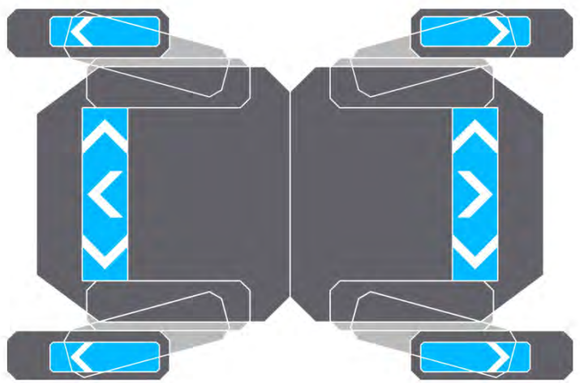
Retracting rain shield, mounted between the two A-pillars, forming a rain shield for the opening when two units are combined.

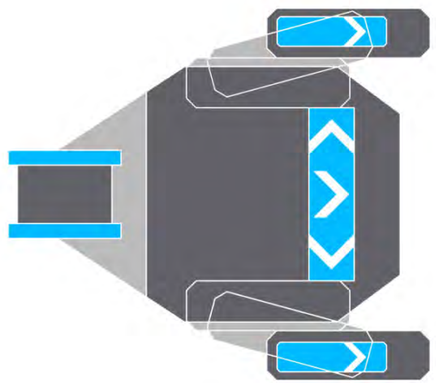
Wheel House Integration

Relocatable wheel house mounted on sled with integrated protection system for travelling with higher speeds.

WHEELCONFIGURATIONS

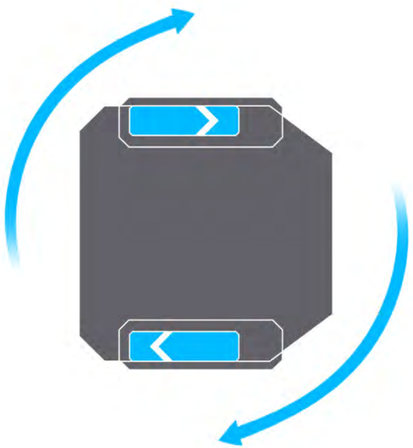


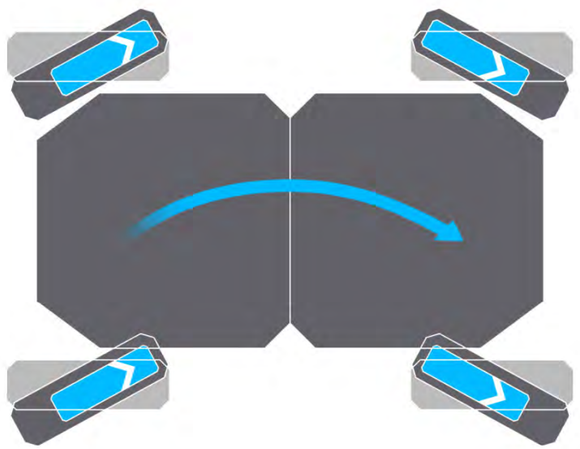


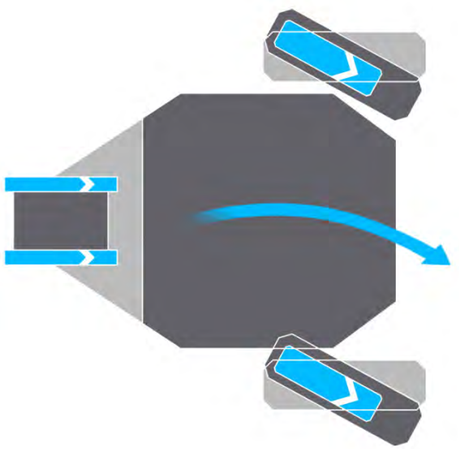


STABILITY

Increasing track width and wheelbase create three different driving dynamics for user scenarios.



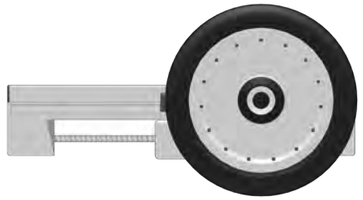


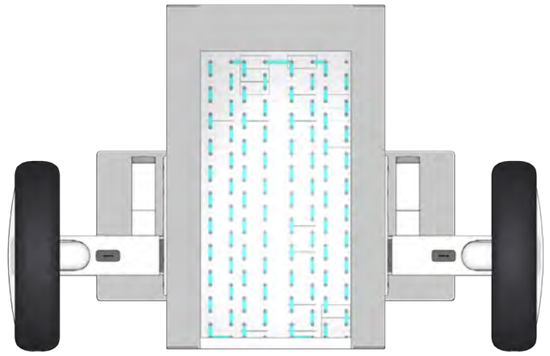


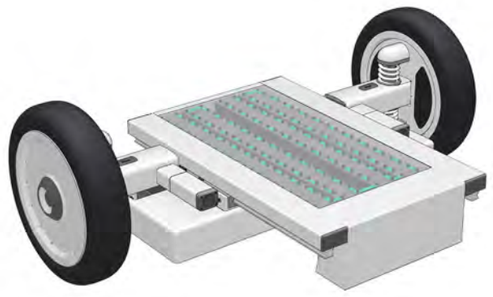
STEERING

Rotation on point in two wheel mode and turnable axis in the back with four wheels allow small turning circles.

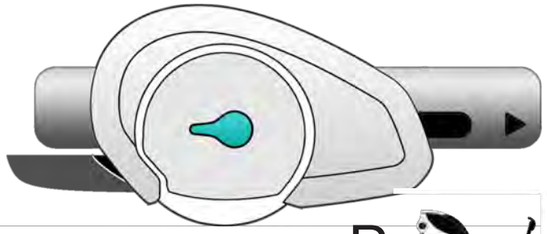
MOVABLESLED

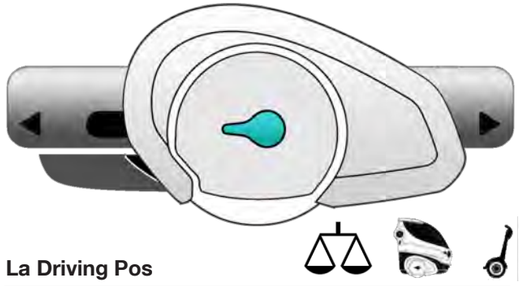




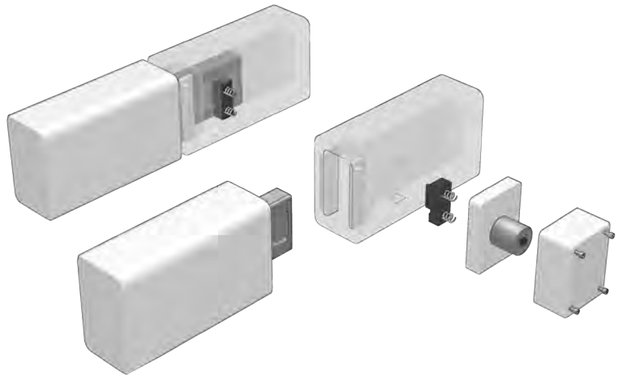


The horizontal moving sled with integrated battery and the positioning of the electric steering units extend from a rotating mode in La configuration to a more conventional steering mode in LaLa and LaGi formation. Gemini keeps balance with a moving sled in x-axis. A Segway principle based on sliding, not rotation, is used for stability while moving in the La configuration. The lithium ion batteries is positioned in the protected undercase, the gravity centre of the car. The electric connection between underbody and car is achieved by a flexible chain connection to protect the cables while the sled moves horizontally.



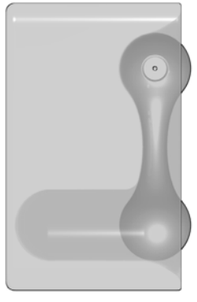


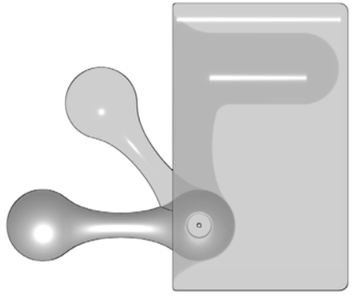
CONNECTIONMECHANISM



Interlocking System

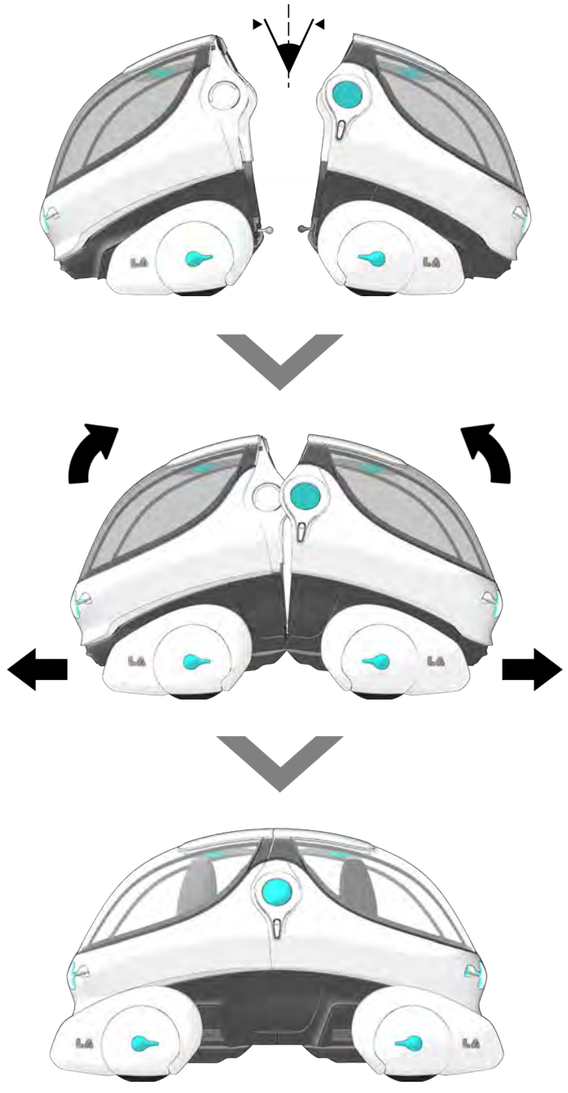
When two LaLa are connected, they are interlocked in four positions to guarantee the safety and stability in higher speeds.





Unit Connector

A fold out connector serves as clutch between the La and Gi units. It also serves as the closure of the electrical circuit of the two cars and the add-on.

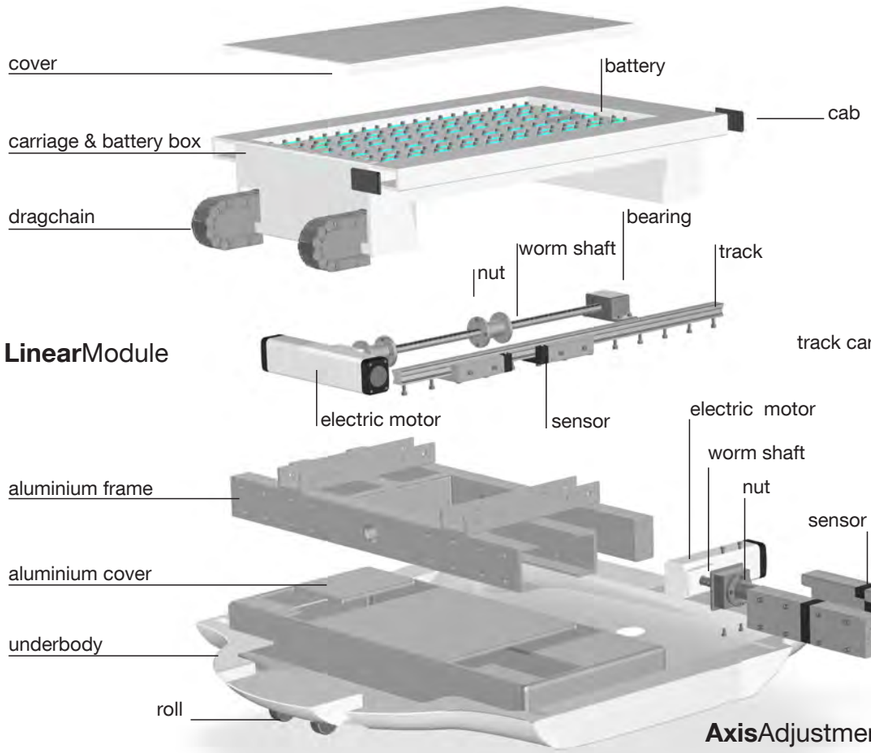


Connection Mode

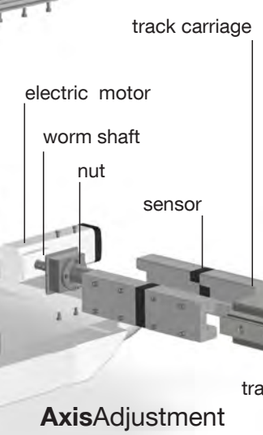
Automised Locking

LaLa Configuration

DRIVEUNIT

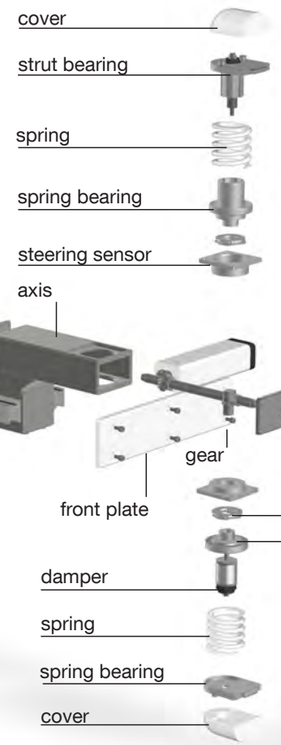


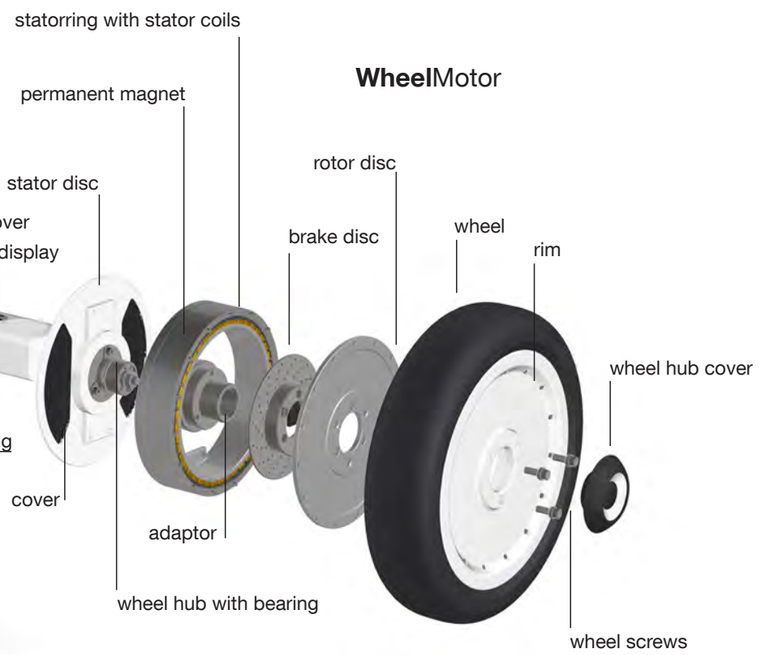
LinearModule



AxisAdjustment

ElectricSteering

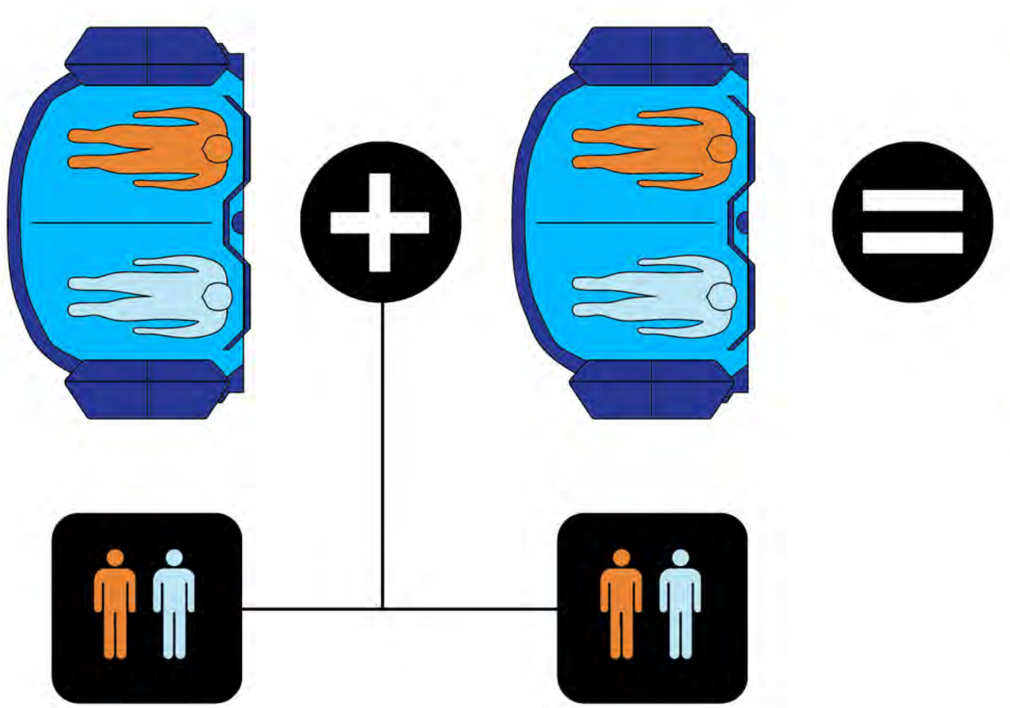


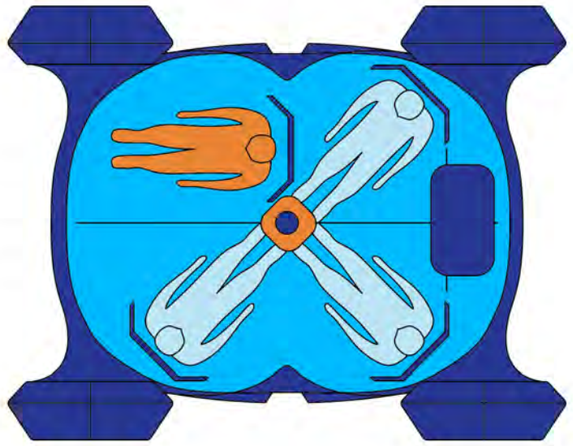


WheelMotor

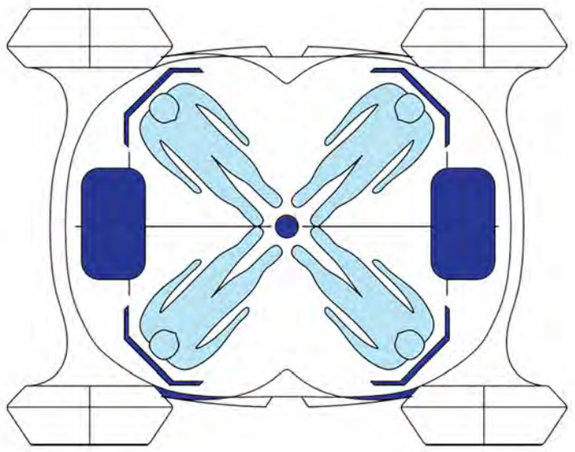
Interior

The main characteristica of the Gemini interior are it‘s versatile way of use, transformation and strong focus on communication among it‘s users in the different configurations.





CONNECTDRIVE



The Automatic Drive Train Constellation would not need the necessity of a specific driver. In addition extra plug/in units can be transported. This Mode is a rather futuristic constellation.

INTERIORFL

Personal Console

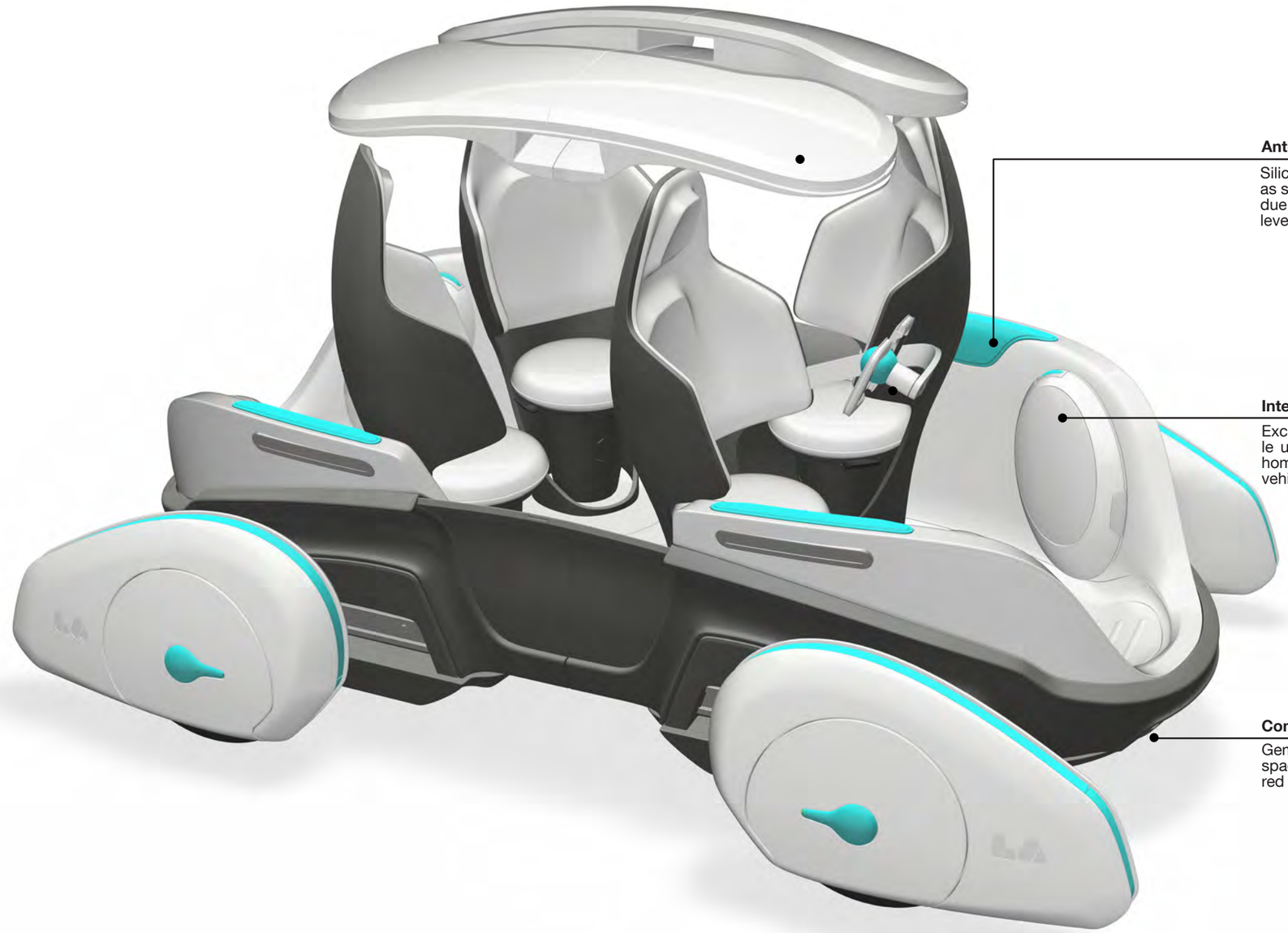
Multi-functional interface for e
ger - comparable to airraft cor

Rotatable Seats

360° rotatable seats surrounc
with integrated security syste
seating, rear panel, airbags,
technics into one single install

Central Access

Common, barrier free entry fro
of the vehicle for comfortabl
cess. Central entrance for all p



Anti-Slip Armrest

Silicone gel pad both as armrest as well as shelf space, holding objects on a slope due to occuring vacuums on microscopic levels.

Interior Plugin

Exchangeable plug-in units for versatile use of the cars interior, enabling easy home integration and customization of the vehicle's features.

Communication Space

Gemini creates a lively communication space in its 4-seater configuration, centered around its entertainment unit.

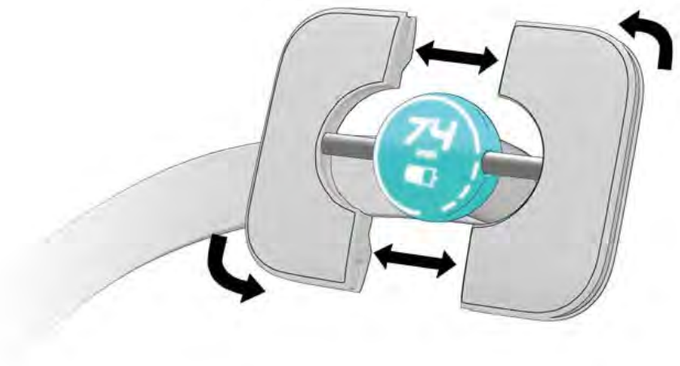
1. La Configuration

CONTROLUNIT

SteeringGeminiLa

When in La configuration, the control unit is retracted and its both sides can be tilted to control the acceleration of each tire.

As the two driving mechanics of the Gemini La and LaLa differ fundamentally, the change in wheel configuration must be reflected in the steering mechanism. In two wheel mode, both wheelhouses are accelerated seperately similar to the control of a moon rover, while with four wheels, the axis movement for turning requires a traditional wheel. The control unit is ball bearing mounted, allowing both these main principles as well as adjustment in 360 degrees for different user profiles.

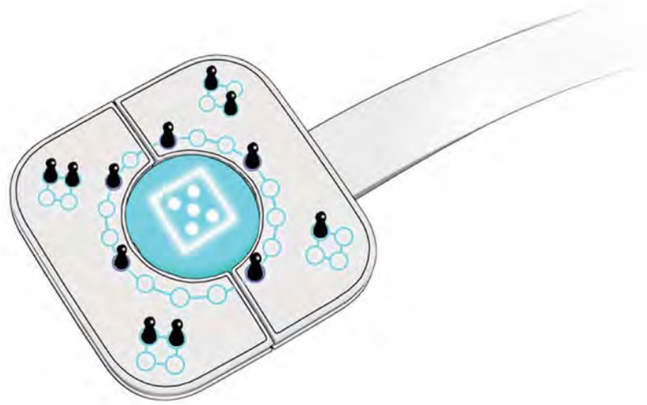


SteeringGeminiLaLa

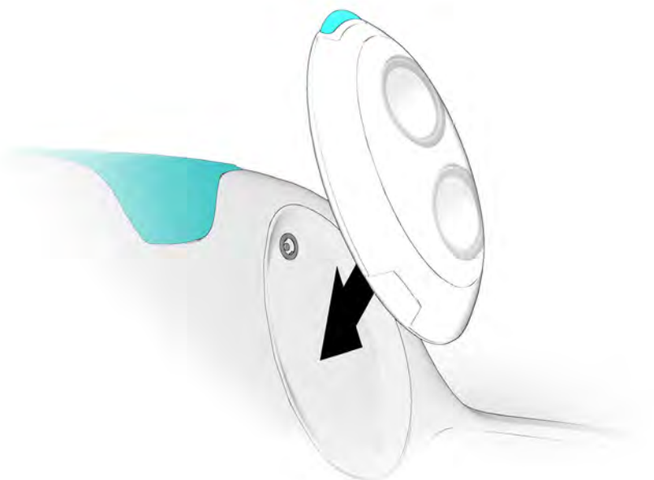
When used as a four person micro-car, the expanded steering unit of the Gemini resembles more a traditional steering wheel.

TravellingGeminiLaLa

The second control unit in the back of the LaLa can be placed in the middle of the passengers as entertainment center.

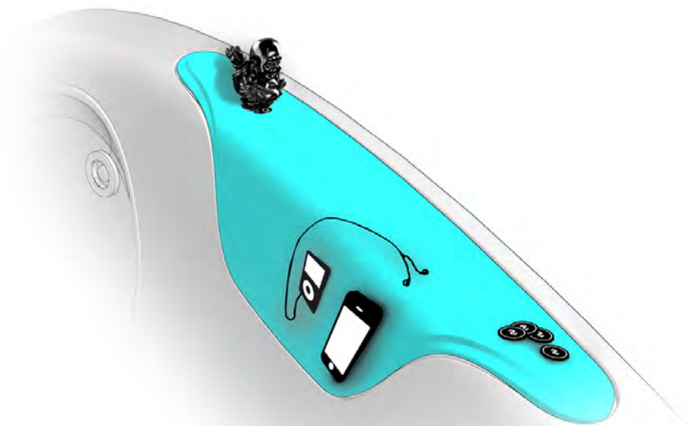


INTERIORDETAILS



Interior Plugin

Exchangeable plug-in units for versatile use of the cars interior, enabling easy home integration and customization of the vehicle‘s features.



Anti-Slip Armrest

Silicone gel pad both as armrest as well as shelf space, holding objects on a slope due to occuring vacuums on microscopic levels.

PersonalConsole

Multi-functional interface for each passenger - comparable to airraft consoles, located right over head for easy use.

Rotatable Seats

360° rotatable seats surrounding the driver with integrated security system - bringing seating, rear panel, airbags, steering and technics into one single installation part.

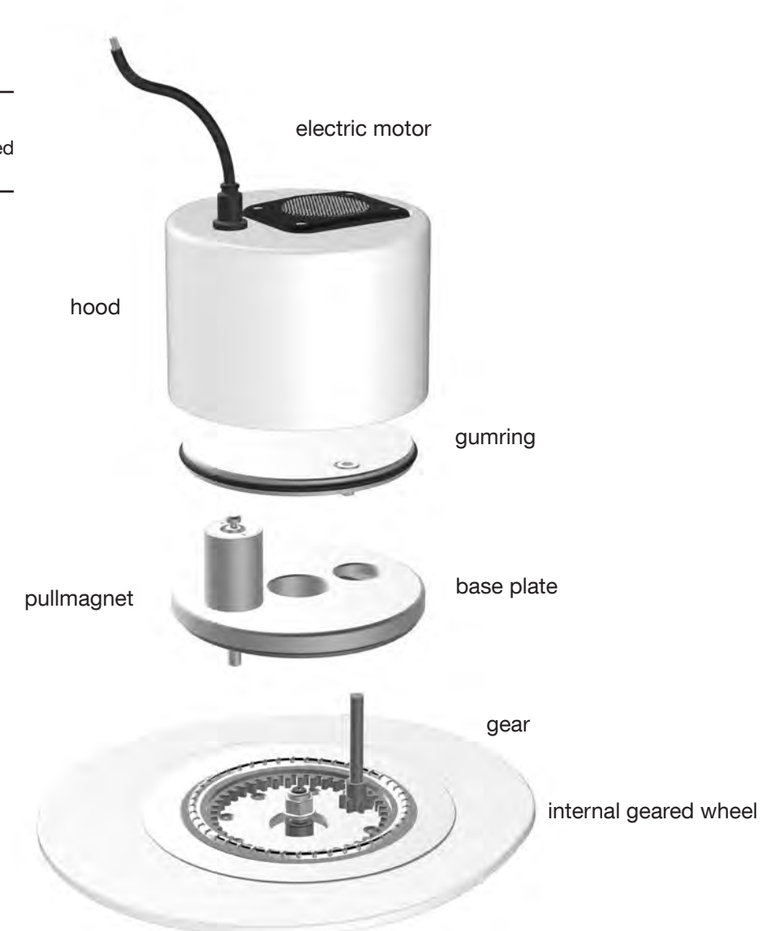
PASSERBY **5M**

PASSERBY **25M**

INTERIORDETAILS

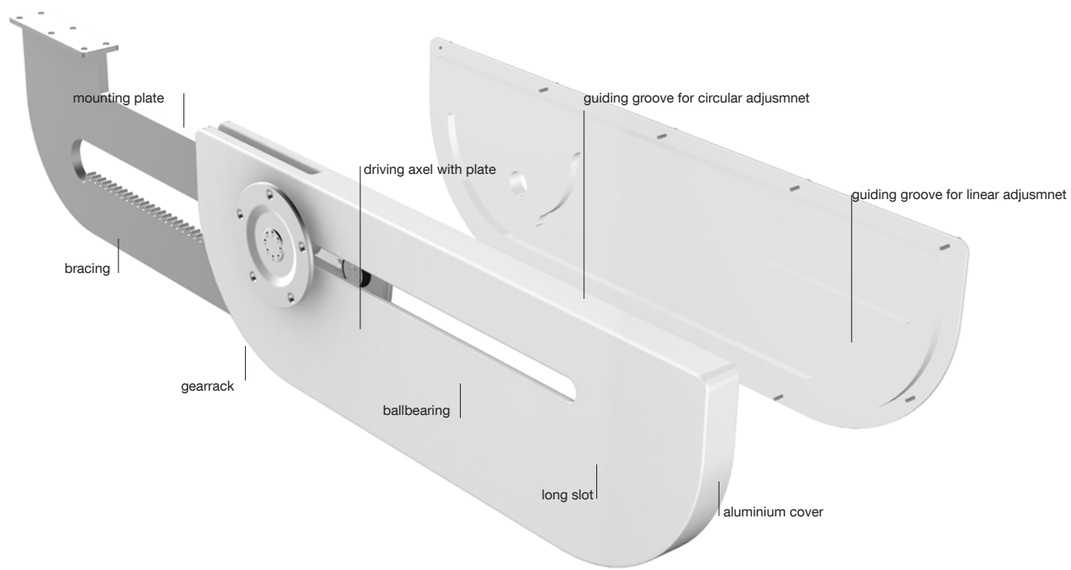
Rotatable Seats - Adjustment Unit

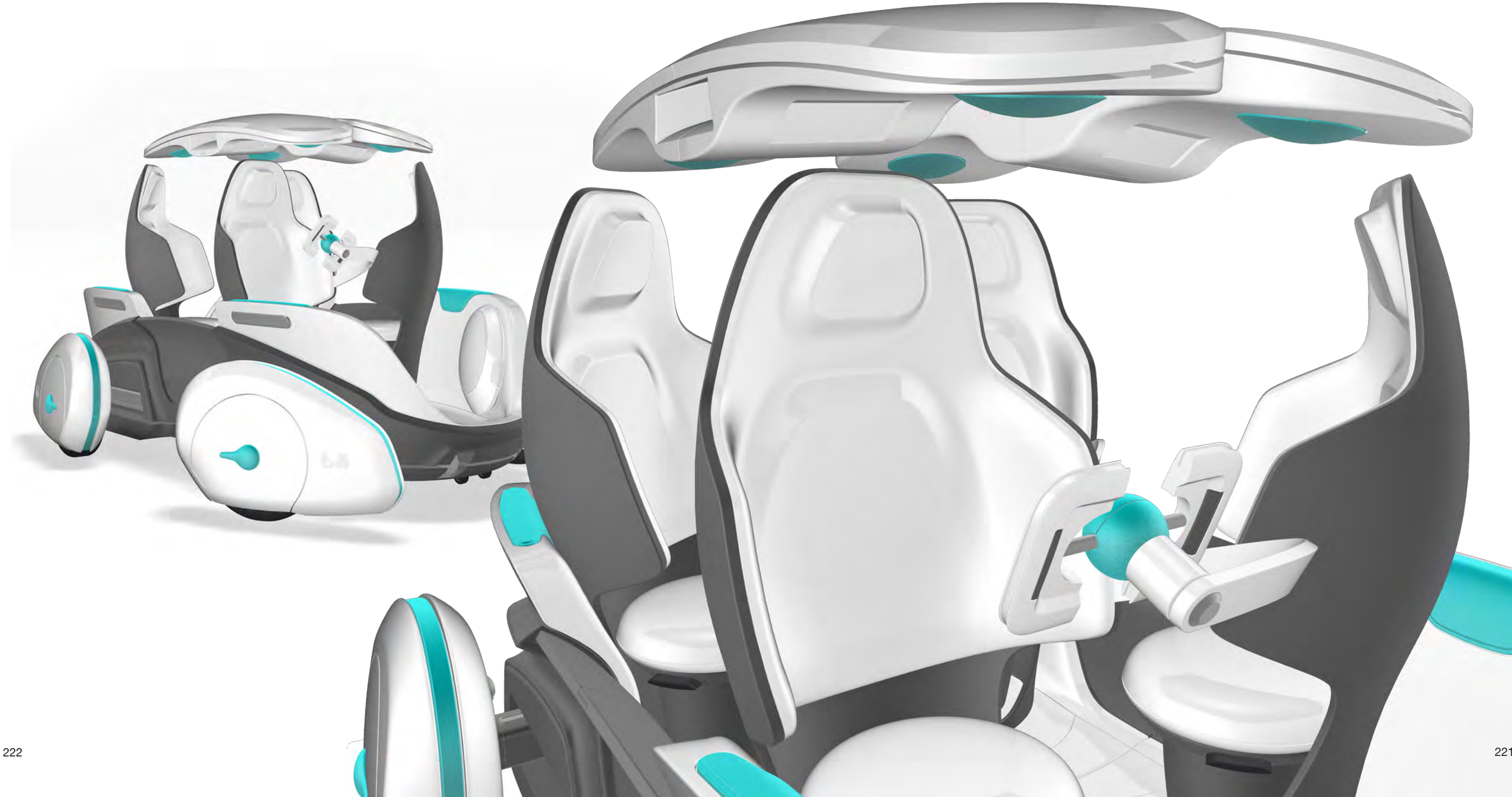
The fully automatic seat rotation is achieved by a small unit inside the seats. .



Opening Mechanism

A rotatable joint mounted on a rail allows the two sided opening mechanisms of the hood.





Gi - Multifunctional Unit

The Gi serves as a range extender, additional trunk and portable battery. It is marketed as an independent product working hand in hand with the rest Gemini product family.

GIFUNCTIONS

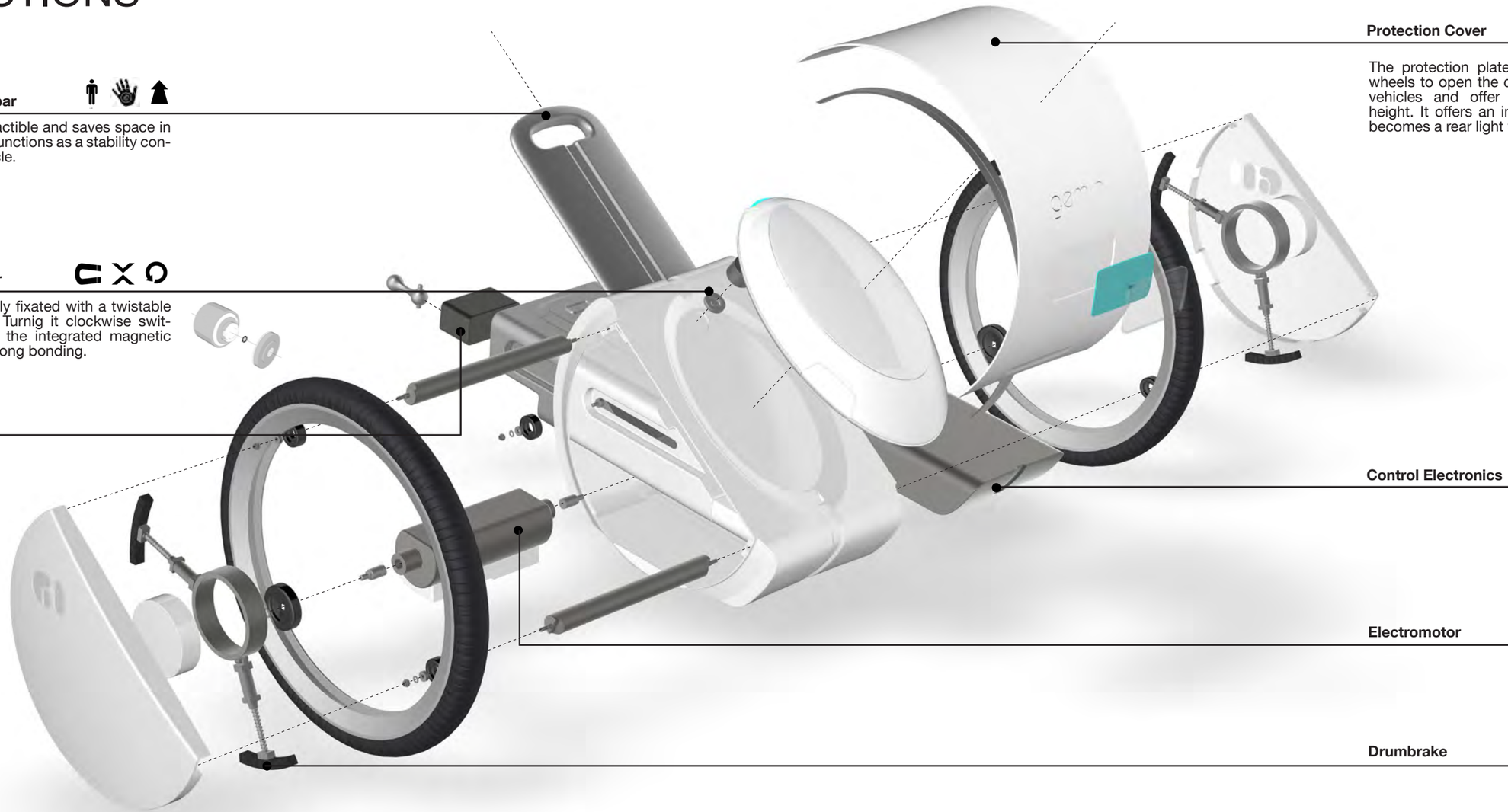
Retractable Handlebar

The handlebar is retractible and saves space in closed mode. It also functions as a stability connector to the La vehicle.

Magnetic Connector

The Plug-Ins are easily fixated with a twistable magnetic connector. Turnig it clockwise switches the position of the integrated magnetic poles an creates a strong bonding.

Range Extender



Protection Cover

The protection plate can spin along the wheels to open the connection unit to the vehicles and offer additional clearance height. It offers an integrated light, which becomes a rear light while in driving mode.

Control Electronics

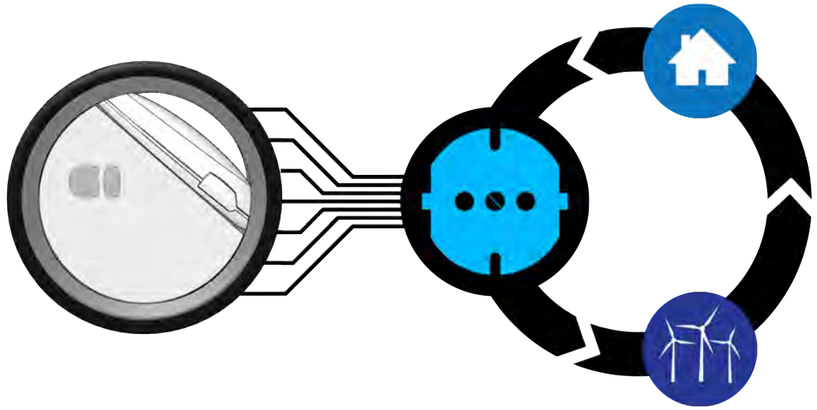
Electromotor

Drumbrake

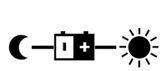
GIFUNCTIONS

Vehicle2**Grid**

Through Vehicle-To-Grid, Gi can communicate with the power grid when disconnected from the La unit and placed at home, at a public charging station, at work or at a driving lot not only to charge the device but also vice-versa to sell demand response services by either delivering electricity into the grid or by throttling their charging rate. The concept allows the vehicle to provide power to help balance loads by ‚valley filling' and ‚peak shaving' or as a buffer during outages.

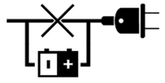


NightStorage

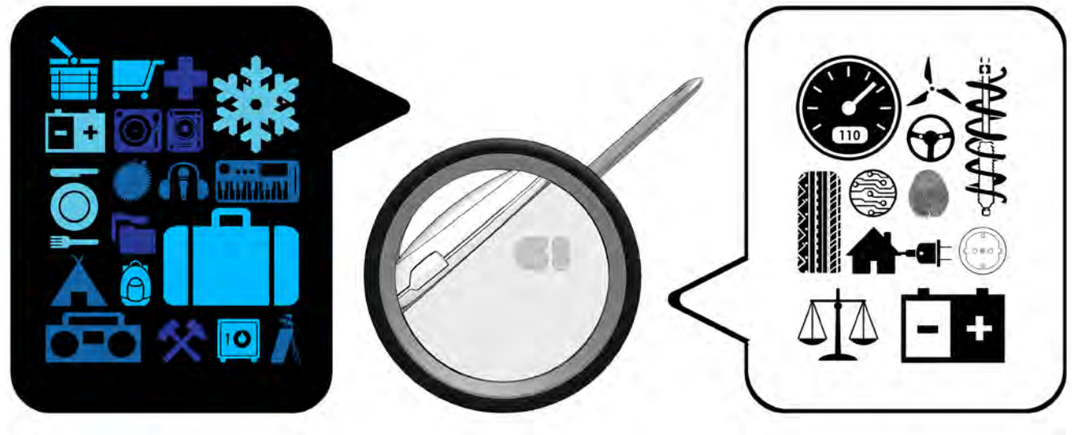


Gi works as night storage to save energy during the evening or at night when base load electricity is available at lower cost, and releases it during the day.

UPS



As an uninterruptible power source (UPS), Gi functions as an electrical backup that provides emergency power when the input power source, e.g. LA, fails.



ModularStorage **Plug-In**

Shopping Cart. Electric Cooler. Suitcase. Safe. Toolbox. First Aid. Shrine Sound Equipment. Mobile Office. Range Extender. Camping Set.

SupportAddOn **Unit**

Long Distance Range Extender. Vehicle to Grid. Power Supply. Top Speed Plus. Curve Layout Improvement. Additional Engine.

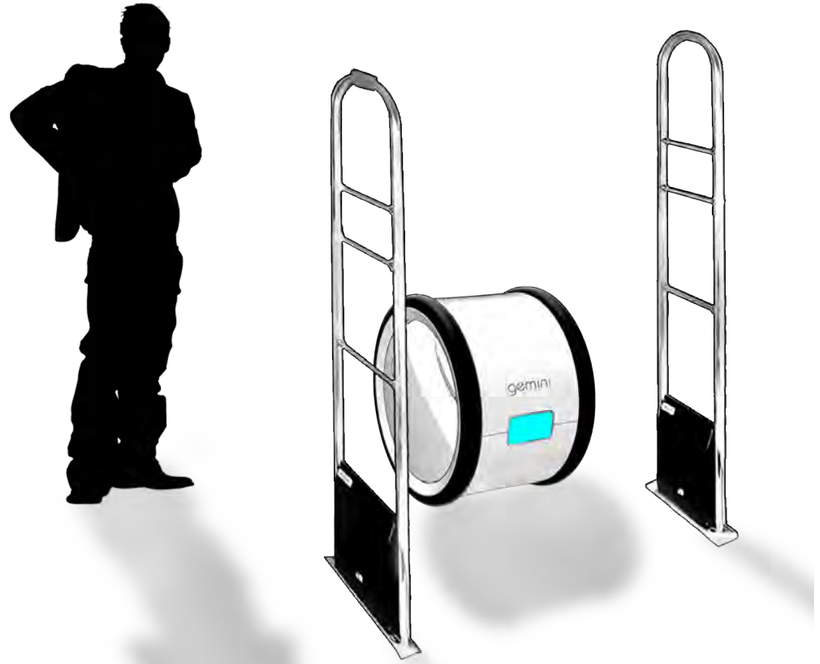
GISCENARIO

AssistedShopping

The GI uses it‘s integrated technics in everyday occasions besides driving mode. The battery, engine and light can be used independently, serving the user in multiple scenarios like shopping.

WirelessPayment

With the help of radio frequency identification through integrated RFID chips, the GI can process cashless payments without the need to remove purchased payments out of it‘s storage compartment.



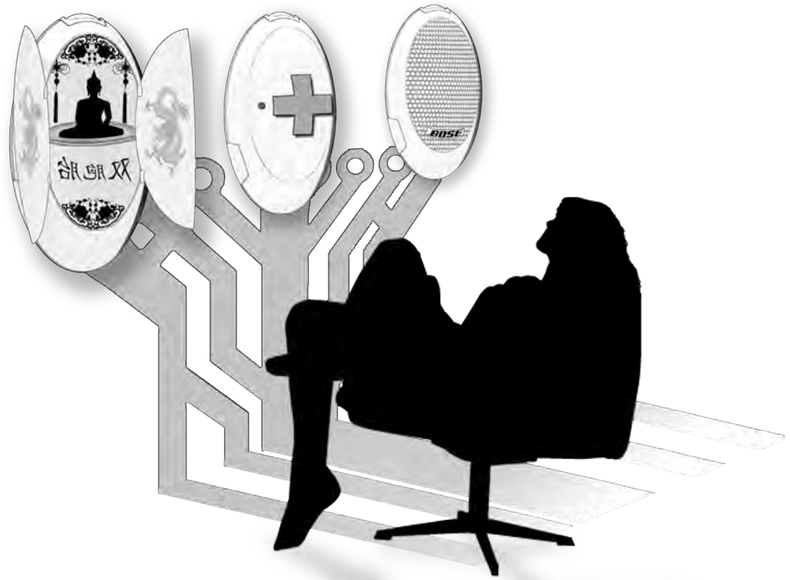
GISCENARIO

HousingInterface

The Gi unit is seamlessly integrated into an HDB home, the main body being stored directly and the home entrance for vehicle to grid connection.

HomeIntegration

Gi's plug in compartment can be used as independent working products, placed as items of furniture - showing versatile way of use provided by various specialised manufacturers.

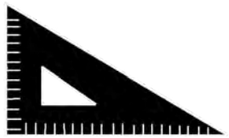


Scenario Implementation

A vision of Singapore and the Gemini Future Mobility Concept was created. Visualisations show the city implementation of the La and Gi units in different situations and allow a little peak into an electric future. The Renderings were created using Autodesk Showcase and Adobe Photoshop.


gemini

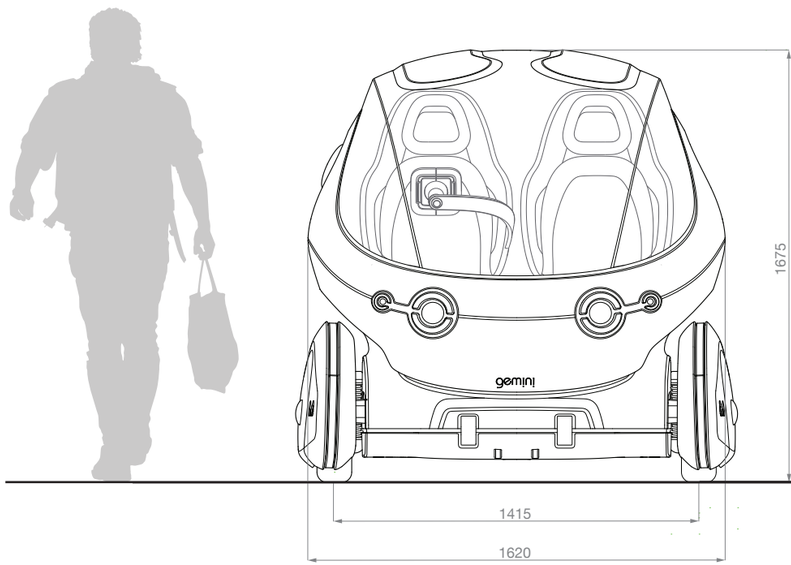

gemini
gemini

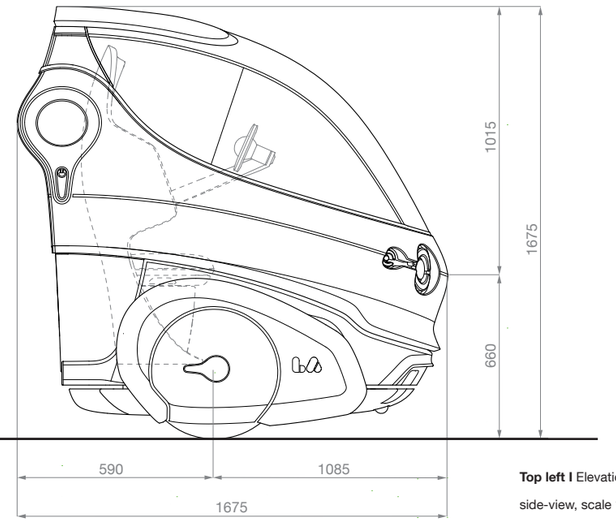


Technical Drawings

In the technical drawings a neutral size and proportion comparison between the Gemeni and other vehicles can be drawn.

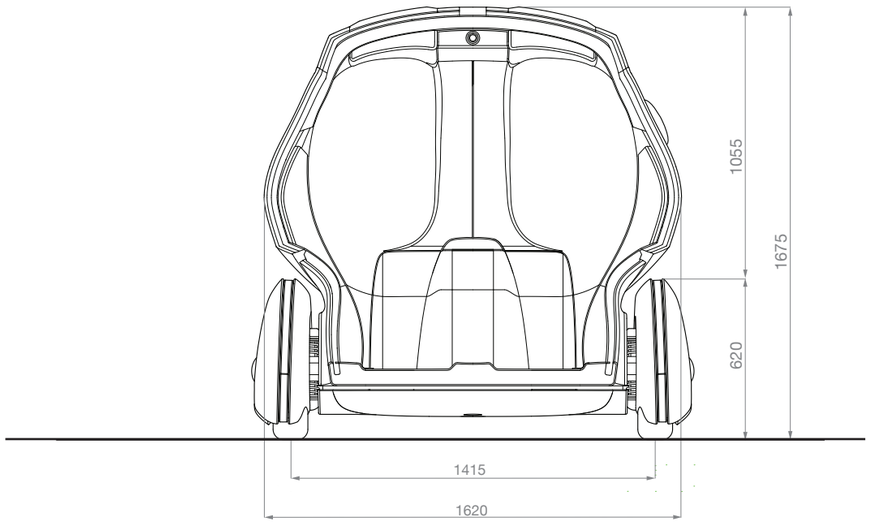
Top left I Elevation Gemini La,
front-view, scale 1:25

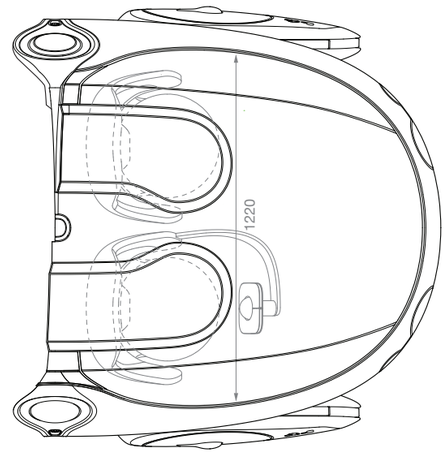




Top left I Elevation Gemini La,
side-view, scale 1:25

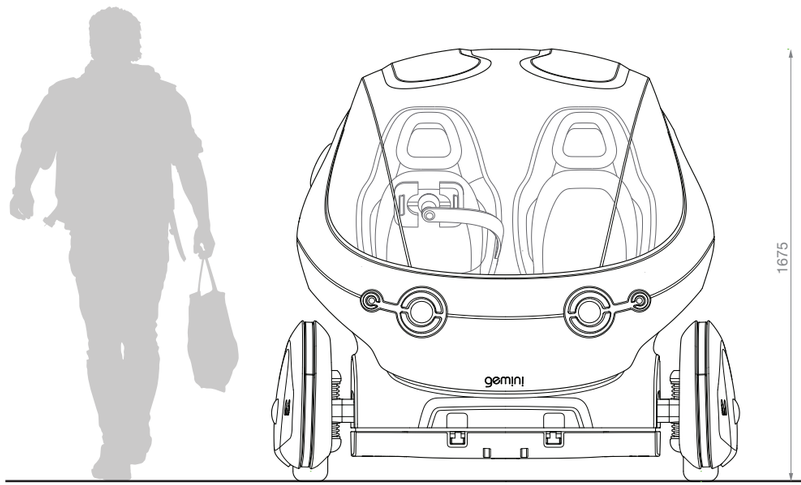
Bottom left I Elevation Gemini La,
rear-view, scale 1:25

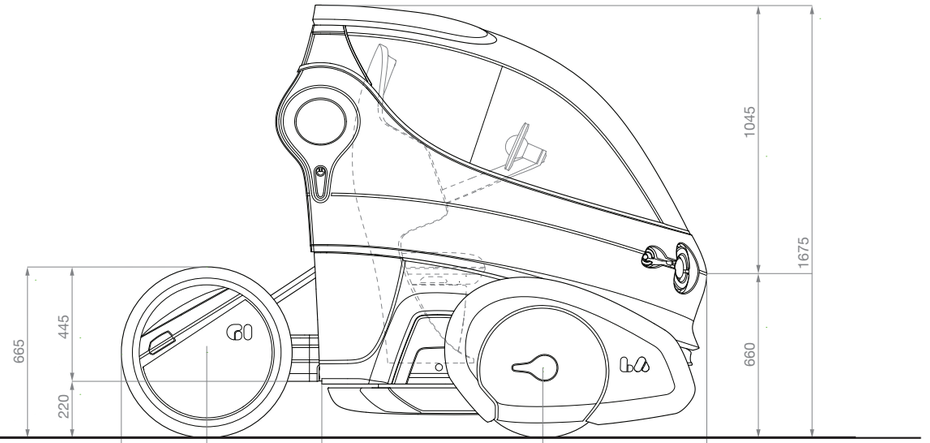




Bottom right I Elevation Gemini La,
top-view, scale 1:25

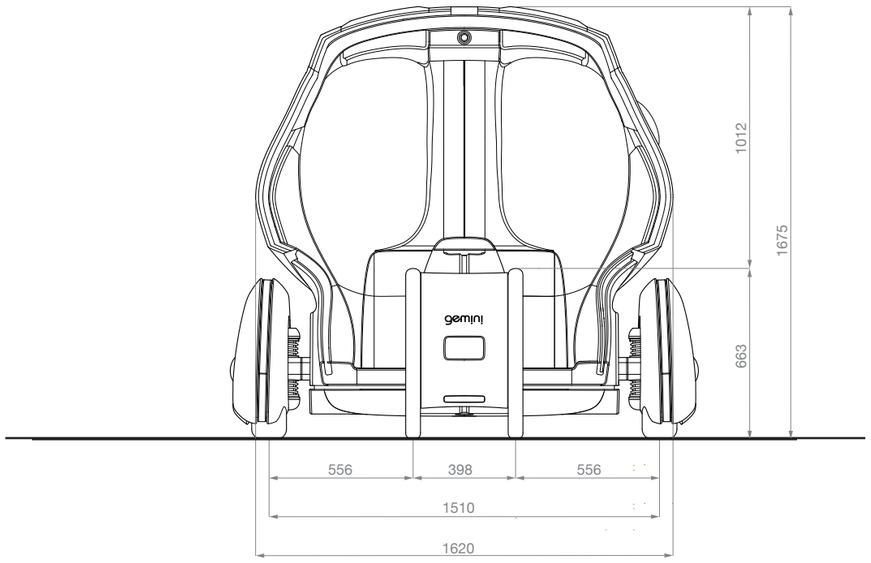
Top left I Elevation Gemini LaGi,
front-view, scale 1:25

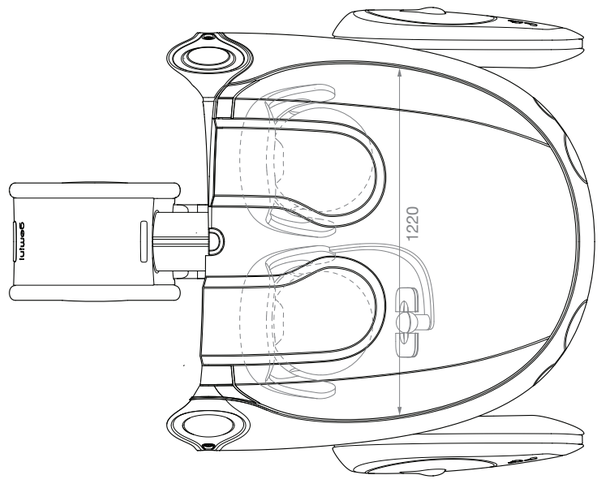




Top left I Elevation Gemini LaGi,
side-view, scale 1:25

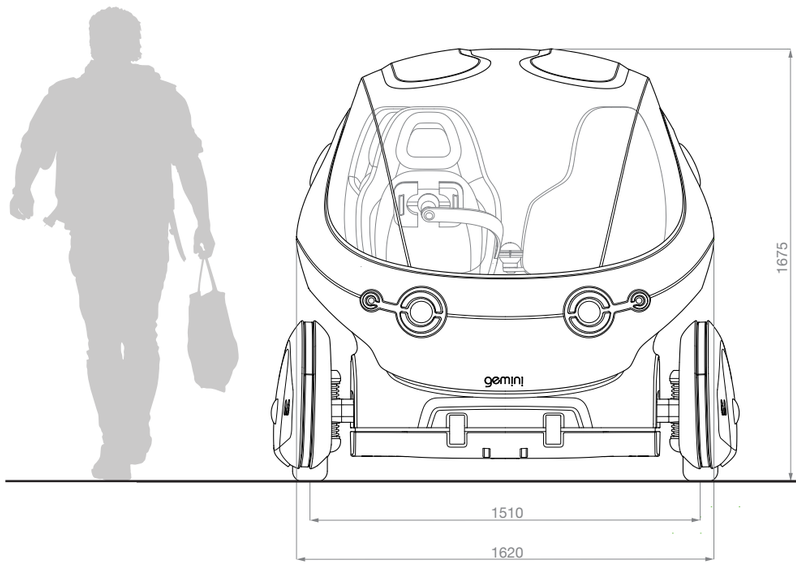
Bottom left I Elevation Gemini LaGi,
rear-view, scale 1:25

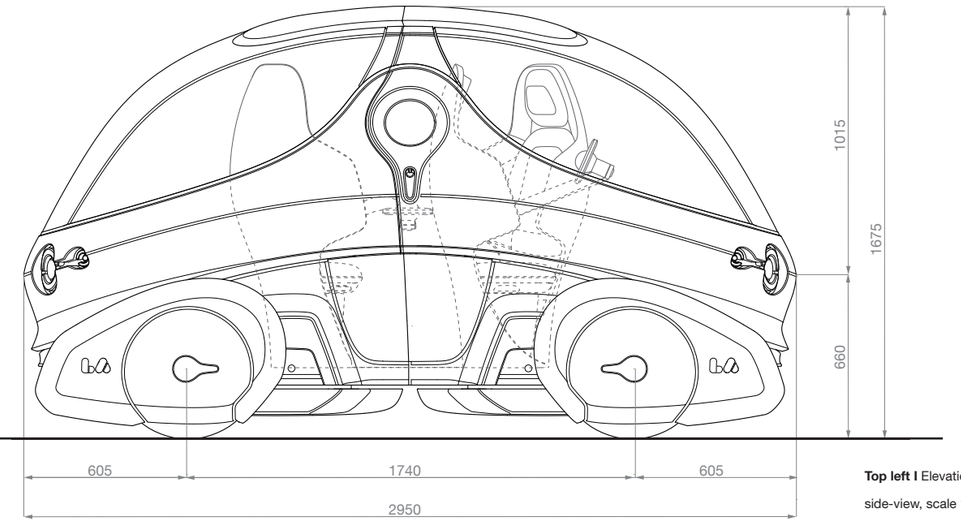




Bottom right I Elevation Gemini LaGi,
top-view, scale 1:25

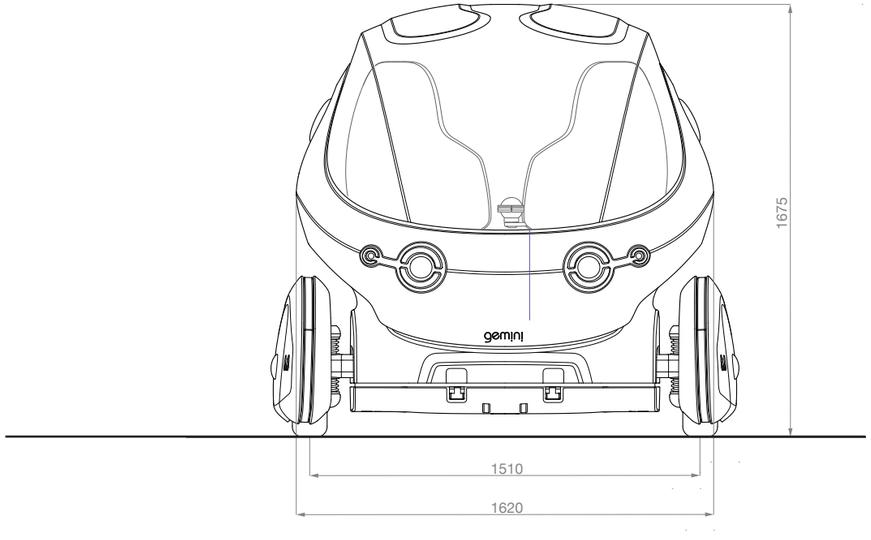
Top left I Elevation Gemini LaLa,
front-view, scale 1:25

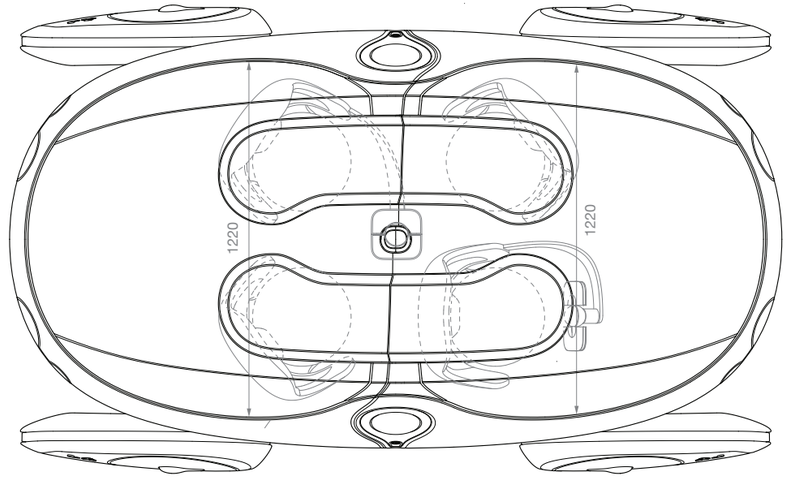




Top left I Elevation Gemini LaLa,
side-view, scale 1:25

Bottom left I Elevation Gemini LaLa,
rear-view, scale 1:25





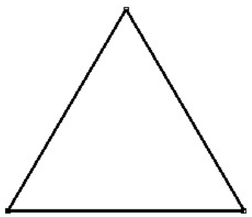
Bottom right I Elevation Gemini
LaLa, top-view, scale 1:25

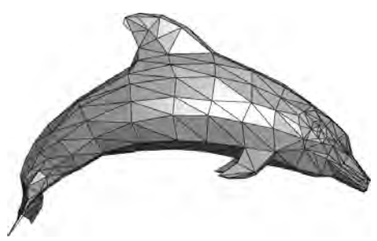
3D Modeling

Contrary to architecture CAD modeing dynamics, surface quality and reflections play a extremely important role in transportation design. The creation of perfect A-Class Surfaces is a time-consuming process in car modeling.

Polygon Surfaces

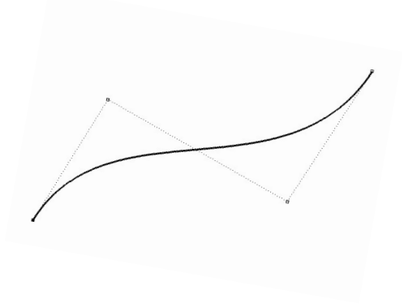
Polygonal modeling is a fast and intuitive way to generate a 3D model.
Usually a mesh consits out of polygons from 3-gons (triangle) to n-gons, which results in only flat surfaces in the model. The triangles are an approximination but can get close to the desired shape by smothening the model. (increasing the number of polygons)
This modelling method is often used in the movie - or game industire.
Common software is for example Autodesk 3D Studio Max, Maxon Cinema 4D or the open source engine Blender.





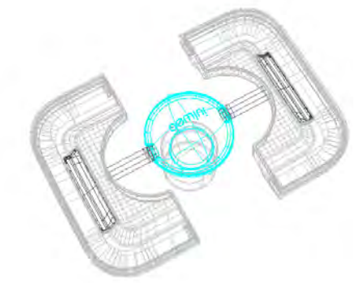
NURBS Surfaces (Non-Uniform Rational B-Spline - Surfaces)

Nurbs surfaces are a complete different way of representing a geometry.
Free form surfaces are build out of mathematical equations which define the positions and shape in three-dimensional space.The computer programs generate an graphical user interface for easy controlling. The shape of the surface is determined by control points.
Nurbs models are common in the automotive design sector and many industrial surfacing branches.



Class A Surface Modelling

In the product industry shapes can be categorised by Class A, B or C surfaces. There is no precise definition of this, but industry wide Class A is where the customer can see (and touch) the surface. In the automotive sector this means exterieur and interieur. To the not visible inner sides if these shapes or structural parts can be refered as Class B surfaces. Class C are surfaces which are used to produce class A and B shapes. For example the ones of a stamping tool.
Another understanding for Class A surfaces is high grade curve and surface continuity which has a direct influence on the quality of the surface flow. This is expecially important for the high glossy and reflective exterieurs in the automotive sector.



The Class A surfaces of this projects 3D model stick to the following eigtht rules :
1. The fillets - Generally for Class A, the requirement is curvature continuous and Uniform flow of flow lines from fillet to parent surface value of 0.005 or better (Position 0.001mm and tangency to about 0.016 degrees)
2. The flow of the highlight lines - The lines should form a uniform family of lines. Gradually widening or narrowing but in general never pinching in and out.
3. The control points should form a very ordered structure - again varying in Angle from one Row to the next in a gradual manner (this will yield the good Highlights required).
4. For a Class A model the fillet boundary should be edited and moved to form a Gentle line - and then re-matched into the base surface.
5. Matched iso-params in U & V direction are also a good representation of class A.
6. The degree (order) of the Bezier fillets should generally be about 6 (also for arc Radius direction) sometimes you may have to go higher.
7. We also take care of Draft angle, symmetry, gaps and matching of surfaces Created with parent or reference surfaces.
8. Curvature cross-section needles across the part - we make sure the rate of Change of curvature (or the flow of the capping line across the top of the part) is Very gentle and well behaved. „

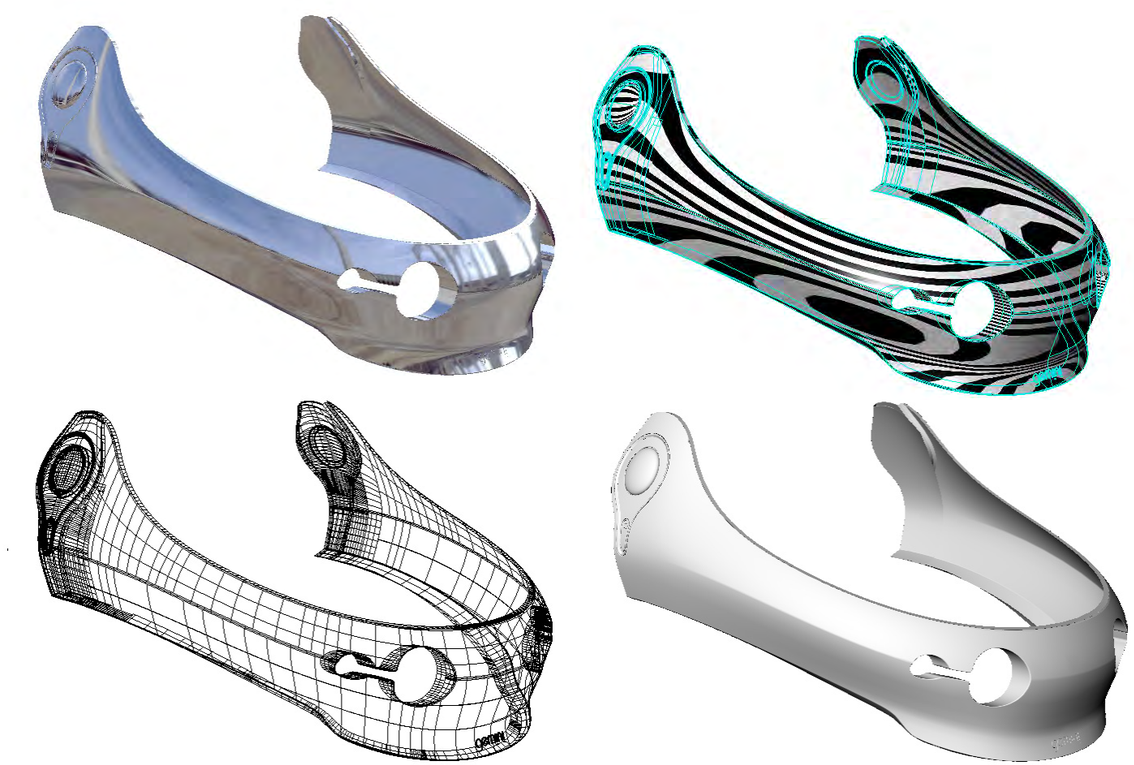
Left | Autodesk Showcase Test Rendering

Curve and Surface Continuity

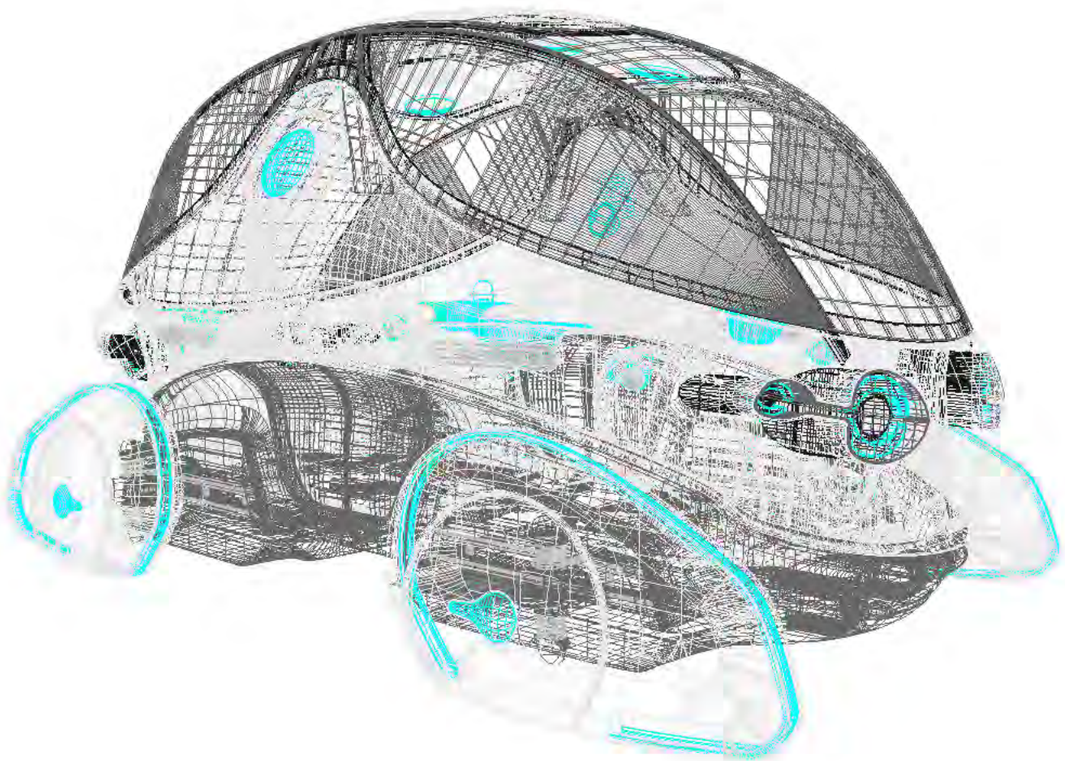
A car body is usually composed out of several patches, fitted together in such a way, that the boundaries are invisible. This is expressed by the geometrical continuety. In order to get an continious reflection the at least G2 is needed.

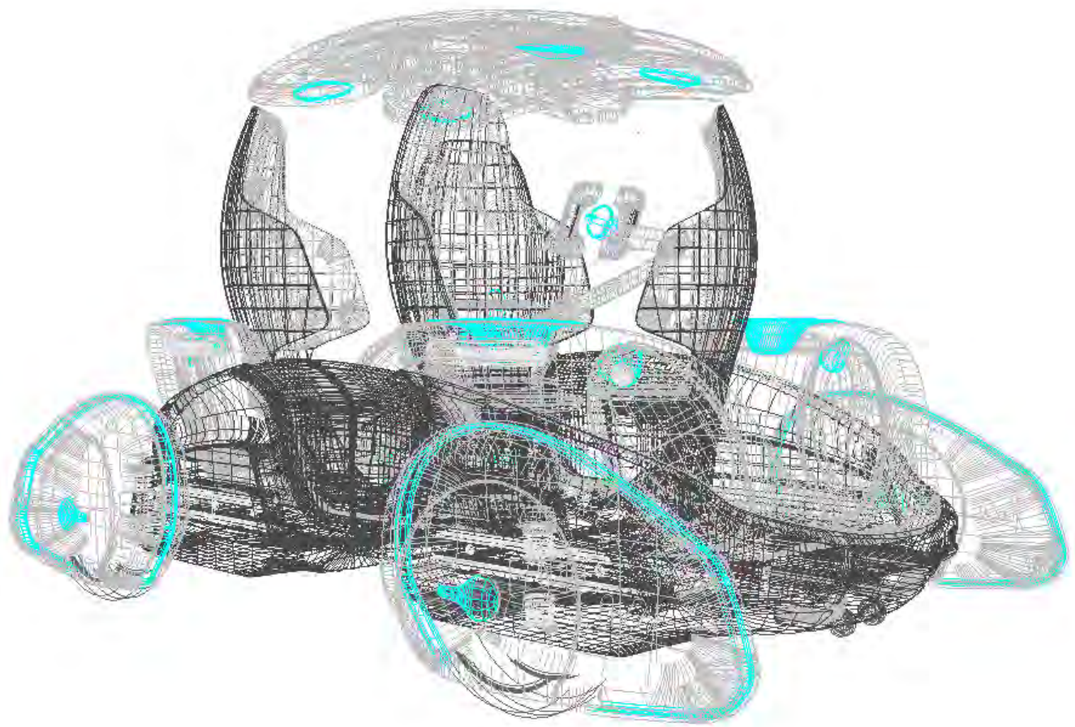
Curve and Surface Analysis

G0: Position (touching)
patches are just touching, could have a nick
G1: Tangent (angle)
Tangent matches; curvature does not match
G2: Curvature (radius)
Position, curvature, and tangency match
G3: acceleration (rate of change of curvature)



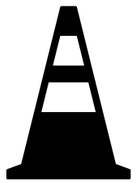
WIREFRAME**MODEL**





MOCKUP**HISTORY**

MOCKUP**HISTORY**



Presentation Model

In the course of the design project two 1:5 scale models and several models in the scale 1:25, inserted in an infrastructure model of future Singapore, were created. The models show the functionality of the future mobility project and are presented to the public in the end of july. Rapid Prototyping was the only solution to create the scale models in the tight time frame until presentation. With the help of TUM Create and Hasenauer & Hesser GmbH it was possible to reveal the detailed representations of the design to the public in the diploma presentaion at Technical University Munich.

Model Scale and Production Method

1:5 was chosen as a scale to present one interior and one exterior model to show the high grade of detailing in the vehicle‘s structure and assembly. An the infrastructure model (scale 1:25) provides an insight in the Singapore future mobility conept the final product, showing the differnt ways of use in several situations of the transportation design.

The presentation models were manufactured with the help of Hasenauer & Hesser. Rapid prototyping provided a perfect solution for presenting these complex geometry models in time. As production method a thermoplastics laser-sintering system was used to manufacture precise scale models of the vehicles.

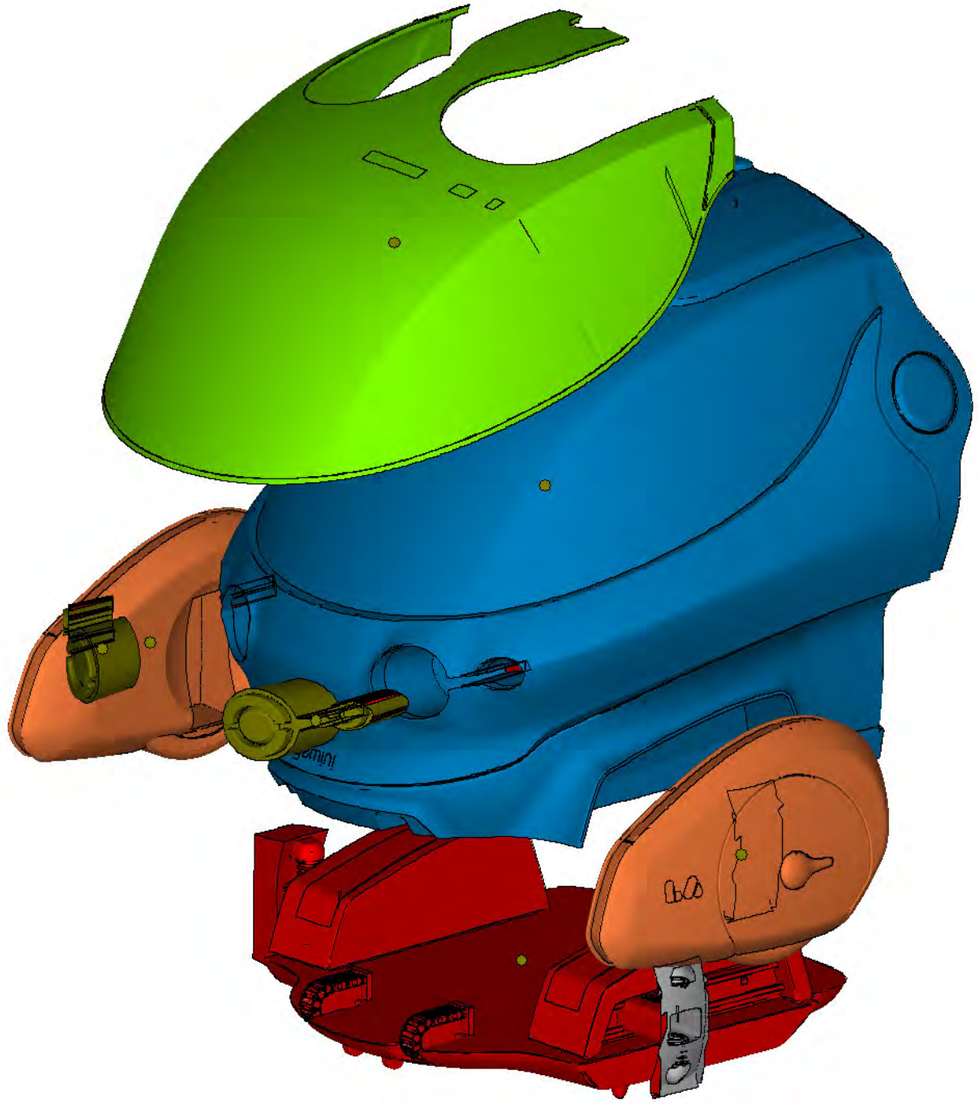
About the Production Company

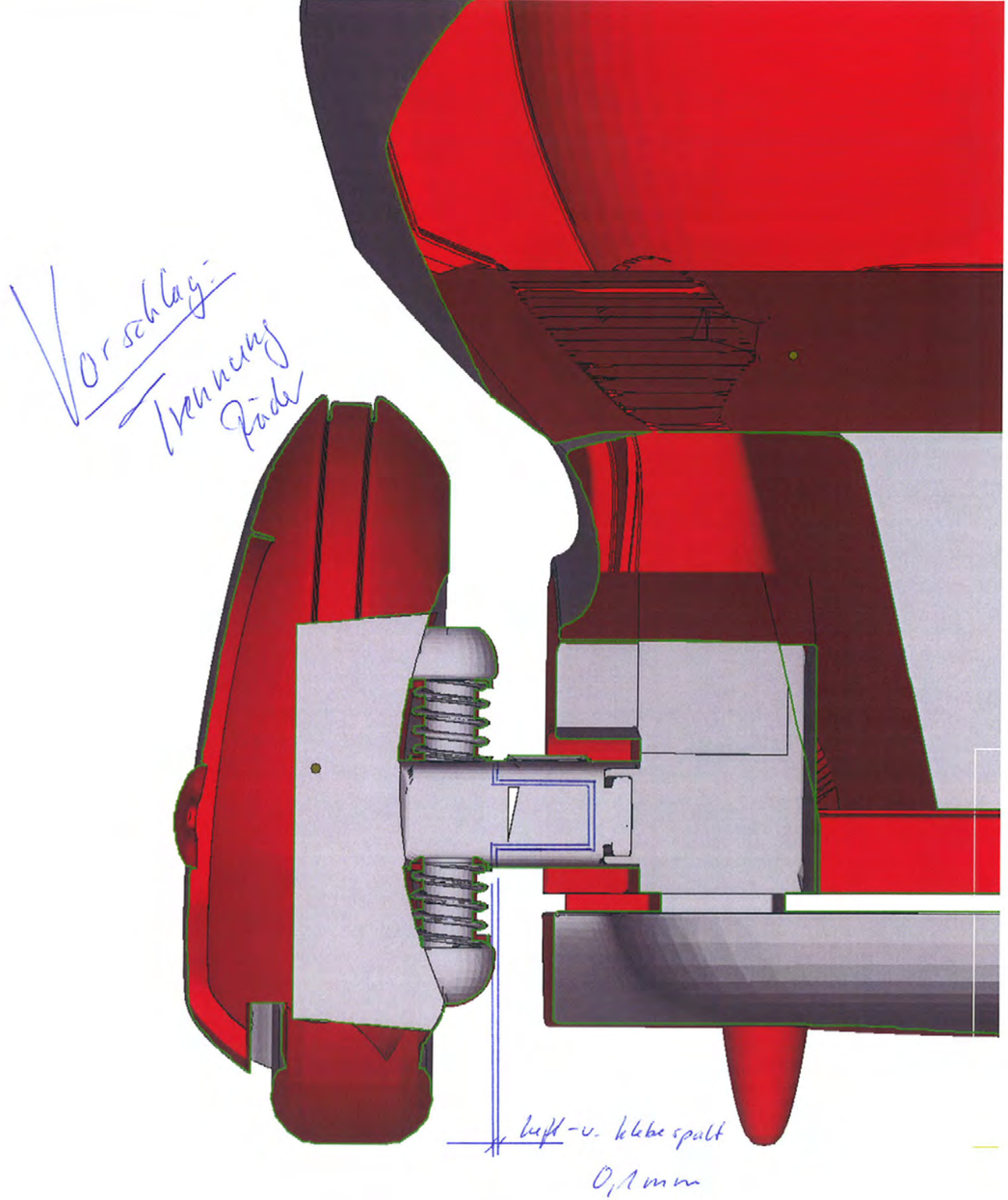
hasenauer & hesser

Hagenauer and Hesser are a young and dynamic engineering and design office specializing in machine, plant engineering and automation technology. They also manufacture laser sintering of plastic parts in service. The company adapts the customer‘s assembly components to the innovative laser procedure.

Opposite | Laser sinthering of the 1:25 scale models

Following spread | Primed, assembled but unfinished 1:5 scale models

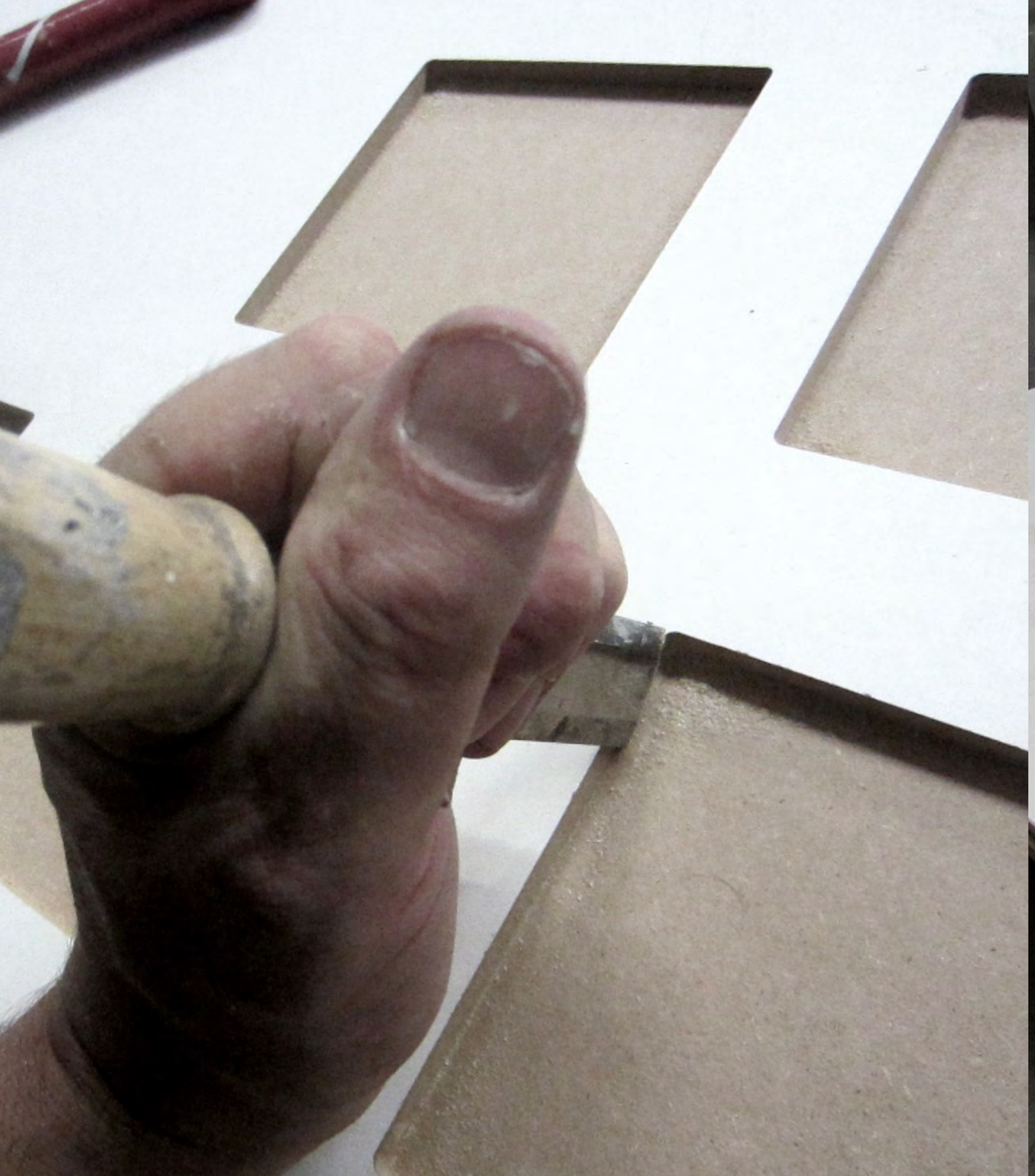




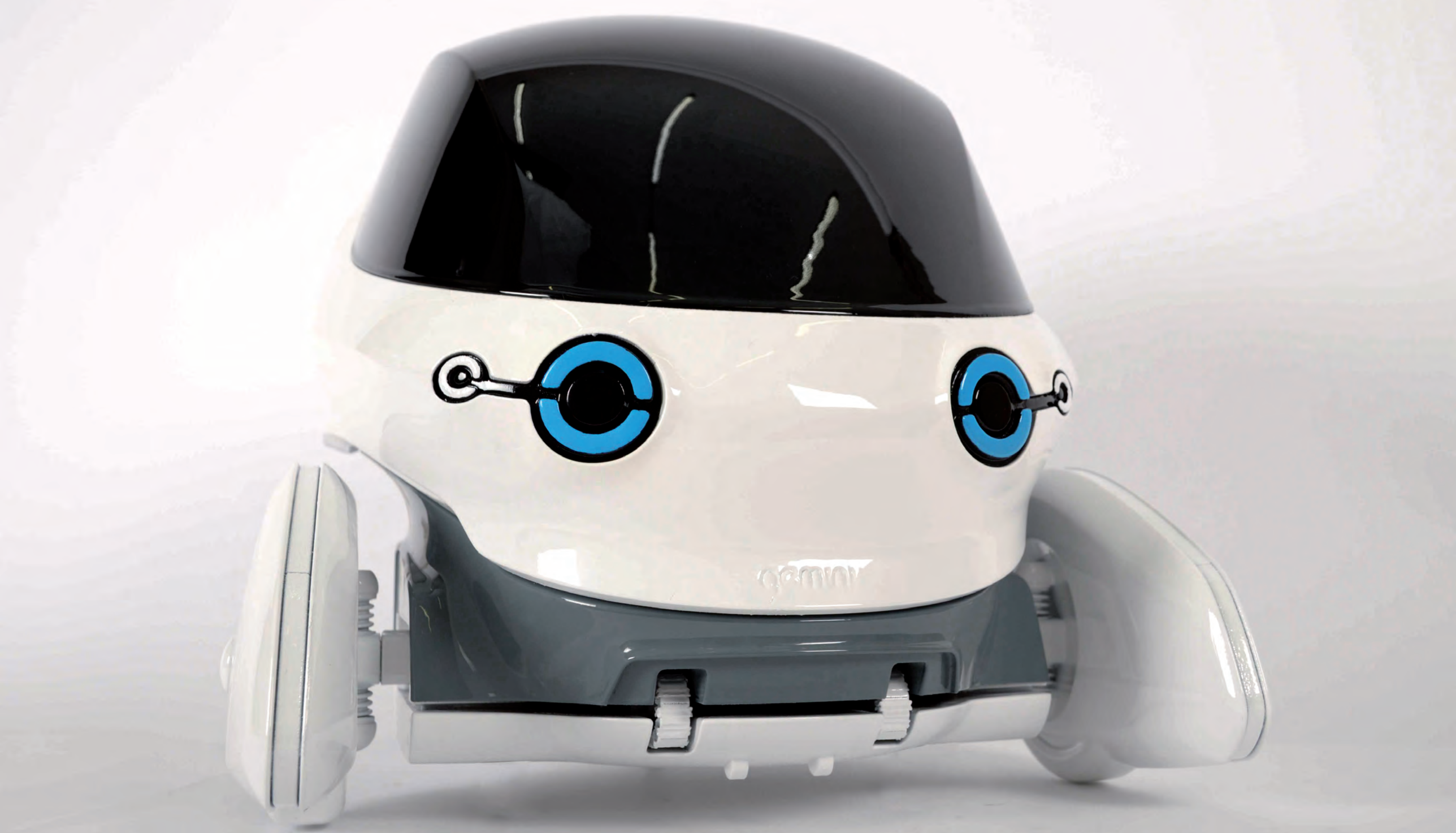
Trennung ist abhängig auch von Farbgebung.

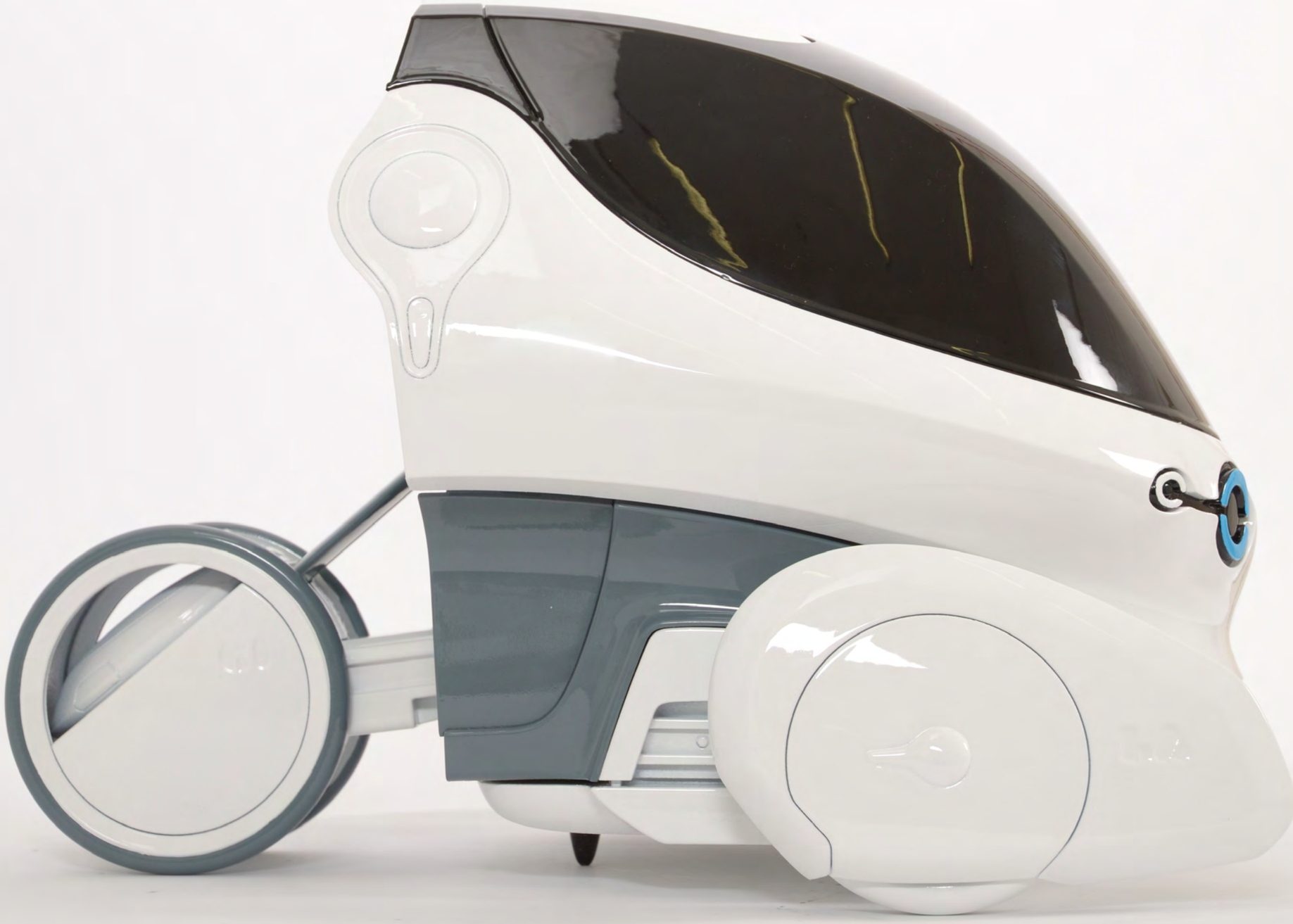

gemini


gemini




SOMET
SPEED





GEMINISCENARIO 1:25

GEMINIINTERIOR 1:5

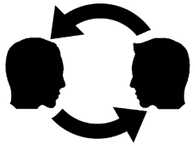
GEMINIEXTERIOR 1:5

gemini

TUM CREATE

hasenauer & hesser

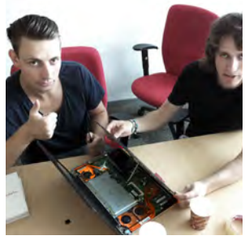

GEMINIINTERIOR 1:5
GEMINIEXTERIOR 1:5
GEMINISCENARIO 1:25
SINGAPOREOVERVIEW
gemini
FUTURE MOBILITY IN THE METROPOLITAN AREA OF SINGAPORE
TUM CREATE
Centre for Electromobility
Singapore

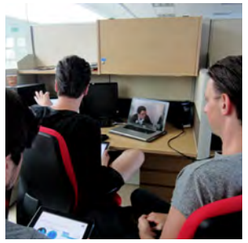


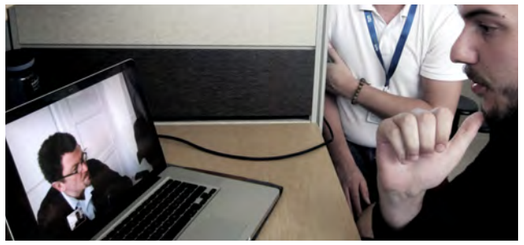
Working at TUM Create

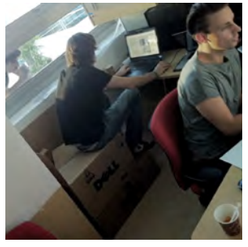
In certain periods the developed intermediate steps were presented in informal meetings with the tutors and assistant professors. Other presentations were held before TUM Create‘s corporate staff, internals and press. Furthermore, there were design reviews by professor Fritz Frenkler and professor Frank Petzold. To keep the design team and the TUM Create staff in good spirits, events like the TUM Create‘s weekend field research trip Malaysia or an internal table soccer tournament were organized.

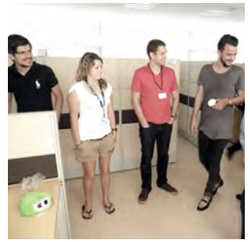
Working at TUM Create and NTU in Singapore

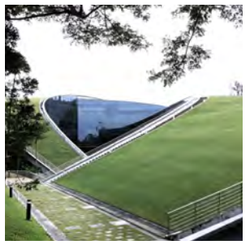


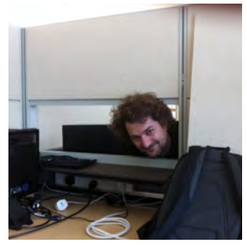












Design Team

The diploma project was drafted by the design team under supervision of professor Fritz Frenkler, the Chair for Industrial Design and TUM Create Singapore. The conceptual design, the documentation, the accompanying book, several presentations, infographics and the final design models on Singapore‘s future mobility were created in the period from March 18th to July 8th 2011 at TUM Create and TU München.

DESIGN**TEAM**

[Marvin **Bratke**]

[Daniel **Tudman**]

[Florian **Abendschein**]

[Paul Clemens **Bart**]

[Simon **Rauchbart**]

TU Munich Professorship

Chair for Industrial Design

Univ. Prof. Dipl. Des Fritz Frenkler

After receiving his diploma in Industrial Design from the HBK Braunschweig, Fritz Frenkler worked at Frogdesign in Germany and the United States. In 1986, he set up and managed Frogdesign in Asia. From 1992 until 1999 Fritz Frenkler served as executive director for the “wiege Wilkhahn Entwicklungsgesellschaft”. Following this, he worked as head designer for the Deutsche Bahn AG and as executive director at Deutsche Bahn Medien GmbH. In addition to this, Professor Frenkler is an acting board member of the if Industry Forum Design Hannover; Chairman of the “if Product Design Award Jury”; Regional Advisor of the International Council of Societies of Industrial Design (ICSD) in Montreal and Member of the Deutschen Designer Club (DDC) in Frankfurt. He is also co-founder of the Universal Design e.V. Hannover.
In 2005 Fritz Frenkler was appointed as an honorary professor in the Industrial Design degree programme at the HBK Braunschweig. He has held the Industrial Design Chair at the Faculty of Architecture at Munich Technical University since 2006
Since 2008, the Department of Industrial Design at the Technical University of Munich, the interdisciplinary degree in Industrial Design Master of Science (M.Sc.) with a PhD opportunity (Dr.-Ing.) For designers, engineers and architects. The ability to work within an interdisciplinary development process is increasingly important as designers increasingly need to be able to act confidently on the borders of their own professional field beyond.
Subject areas of study are the question of an ecologically acceptable mass production, the transformation of society on the basis of demographic change (universal design), and a process-oriented design based on the principle of the new functionalism. In addition, entrepreneurial thinking and action, and methods of design research are taught. An electric car should not just be another car, but here it is for the designer of the new drive with its reduced footprint, lower speed and the extremely low noise, wear formal aesthetic statement. The electric car is just not a car as we were accustomed to. This unique opportunity we try to come in the design.
.

TUM - Chair for Industrial Design

The Technical University of Munich (TUM) is addressed in its Faculty of Architecture at the newly established Department of Industrial Design from the winter semester 2008 / 2009, a four-semester Master of Science degree program. The master‘s program follows a cross-disciplinary cooperation with departments of the faculties of architecture, mechanical engineering and economics. It is the first design program with a PhD opportunity at a technical university in Deutschland. The focus of study includes the communication of an interdisciplinary design understanding and knowledge of design research and training for entrepreneurship. Developed in a unique cooperation with the enterprise, which can in Europe‘s leading university business incubator, student teams products or services for newly established companies.

CEO / Corporate Director

Dr. Markus Wächter

Markus Wächter is Managing Director of the German Institute of Science and Technology - TUM Asia (GIST-TUM Asia). He studied Mathematics with subsidiary Physics subject and received his Diploma degree from TUM in 1997.Until 2004 he was a research assistant at the Institute of Flight Mechanics at TUM and earned his Doctoral degree in engineering with his work on Optimal trajectories in hypersonic fl ight considering transient heating effects. 2004-2005 he worked as a Research Fellow with the Department of Mathematics at National University of Singapore (NUS). Since 2005 he has been working for GIST-TUM Asia and is heading the institute as Managing Director since 2006.

Deputy Corporate Director

Dr. Florian Dötzer

Dr. rer. nat Florian Dötzer is Deputy Corporate Director at TUM Create. He previously headed the Department of Innovation & Research at Jet Aviation, Basel. Studies of electrical engineering at the Technical University of Munich and a Master of Engineering at the City University of New York. Florian Dötzer received his Ph.D. from the Technical University of Munich in the department of computer science on IT security architectures for distributed systems. He served as technical director for the restructuring of an offshore development center in India. Further work stays in Switzerland, Germany, U.S. and France include BMW, Airbus, Altran, BV Capital and Giesecke & Devrient.

Scientific Director

Prof. Harry Hoster

Harry Hoster is Professor at the Institute of Technical Electrochemistry at TUM. Since 2011, he is permanently based in Singapore, being responsible for the TUM CREATE project as Scientific Director. Prior to his professorship, Harry Hoster led a research group at the Institute of Surface Chemistry and Catalysis of Ulm University. That group was mainly working on the elucidation of structure-property relationships of nanostructured surfaces. Harry Hoster was awarded a full fellowship by the German „Fonds der Chemischen Industrie“ to work on a Ph.D. project on model studies for bimetallic anode materials in methanol fuel cells (with T. Iwasita and W. Vielstich).

Scientific Advisor

Prof. Markus Lienkamp

Professor Dr. Ing Markus Lienkamp is Head of the Department of Automotive Engineering at the Technical University of Munich since the end of 2009. In addition, he is responsible for the management of the science center electric mobility and he is the scientific director of the research project TUM Create Electro Mobility in Mega Cities in Singapore. Besides his teaching, professor Lienkamp is advising the Bavarian state government in terms of electric vehicles. Prior to his teaching, he was in various leading positions in the VW group research. Markus Lienkamp developed, together with colleagues and students, the electric car Mute, which will celebrate its premiere at the IAA 2011.

TUM CREATE

TUM CREATE is a research programme sponsored by the Singaporean National Research Foundation (NRF). It is jointly performed by Technische Universität München (TUM, Munich) and Nanyang Technological University (NTU, Singapore), and it aims at the development of innovative technologies and future transportation concepts matching the challenging requirements of fast growing and continuously changing tropical megacities. A central role is played by electric vehicles and all related technologies, e.g., batteries, embedded systems, vehicle technology, and infrastructure. The individual projects and work packages are developed and performed in close collaboration with many industry partners, most of which are located in Singapore. All researchers are academically linked to one or both of the two partner universities TUM and NTU. A vivid exchange of students and scientists is actively supported by the programme.

TUM Create Research Associate
Dipl. Ing. Andreas Schwab

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Dipl. Ing. Sebastian Bender

Imprint

TU Munich

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Chair for Archtiecture Informatics	Univ.-Prof Mark Michaeli
Partner / Sponsor	Hasenauer & Hesser GmbH

TUM Create Singapore

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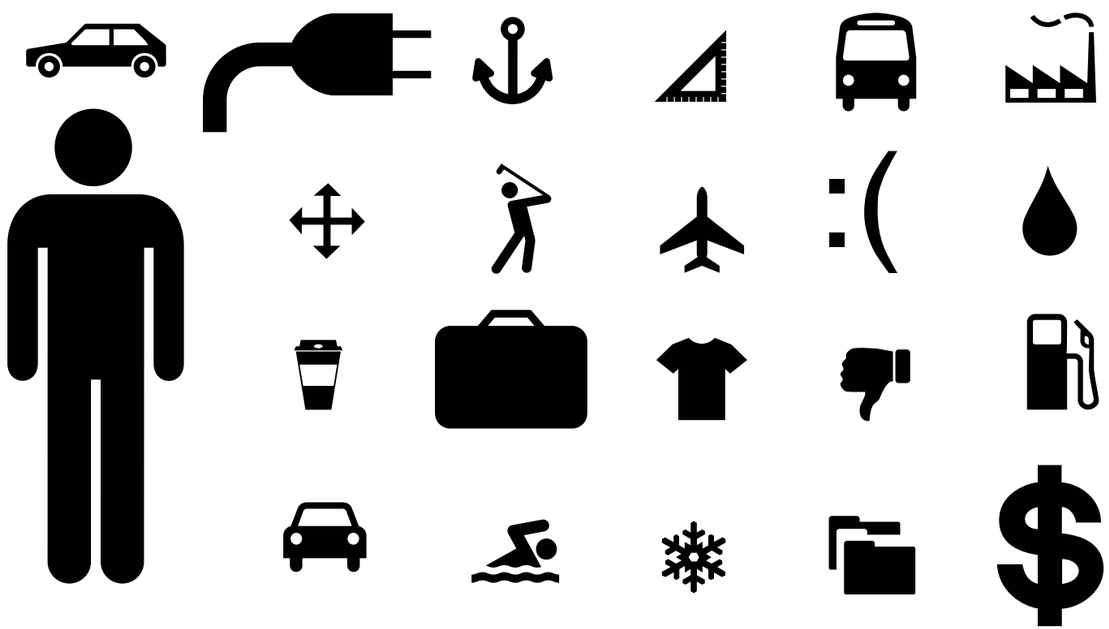

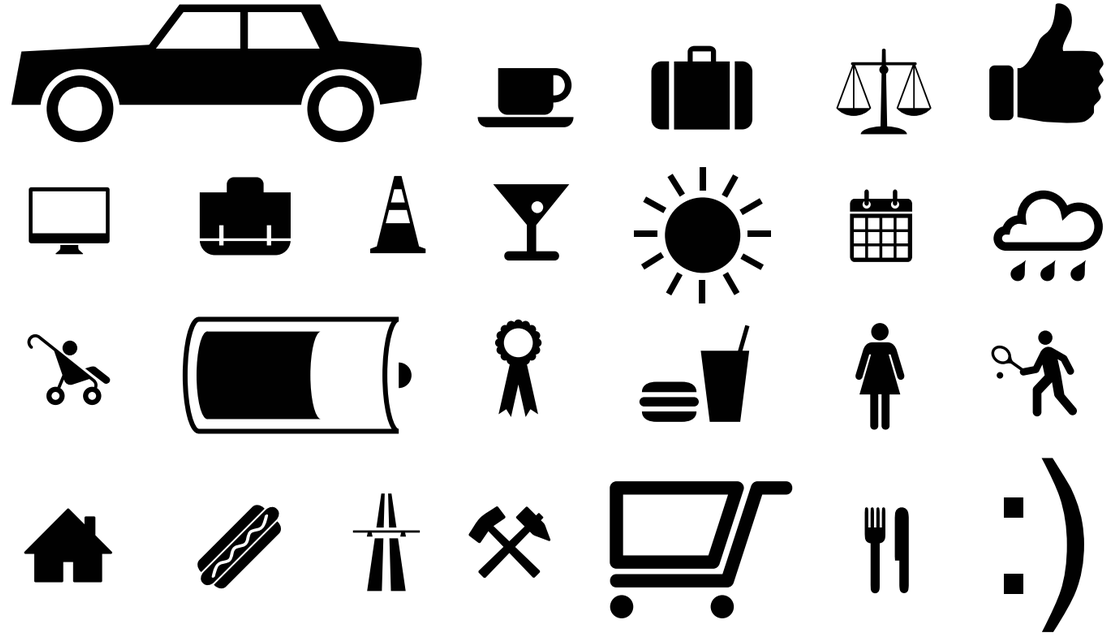

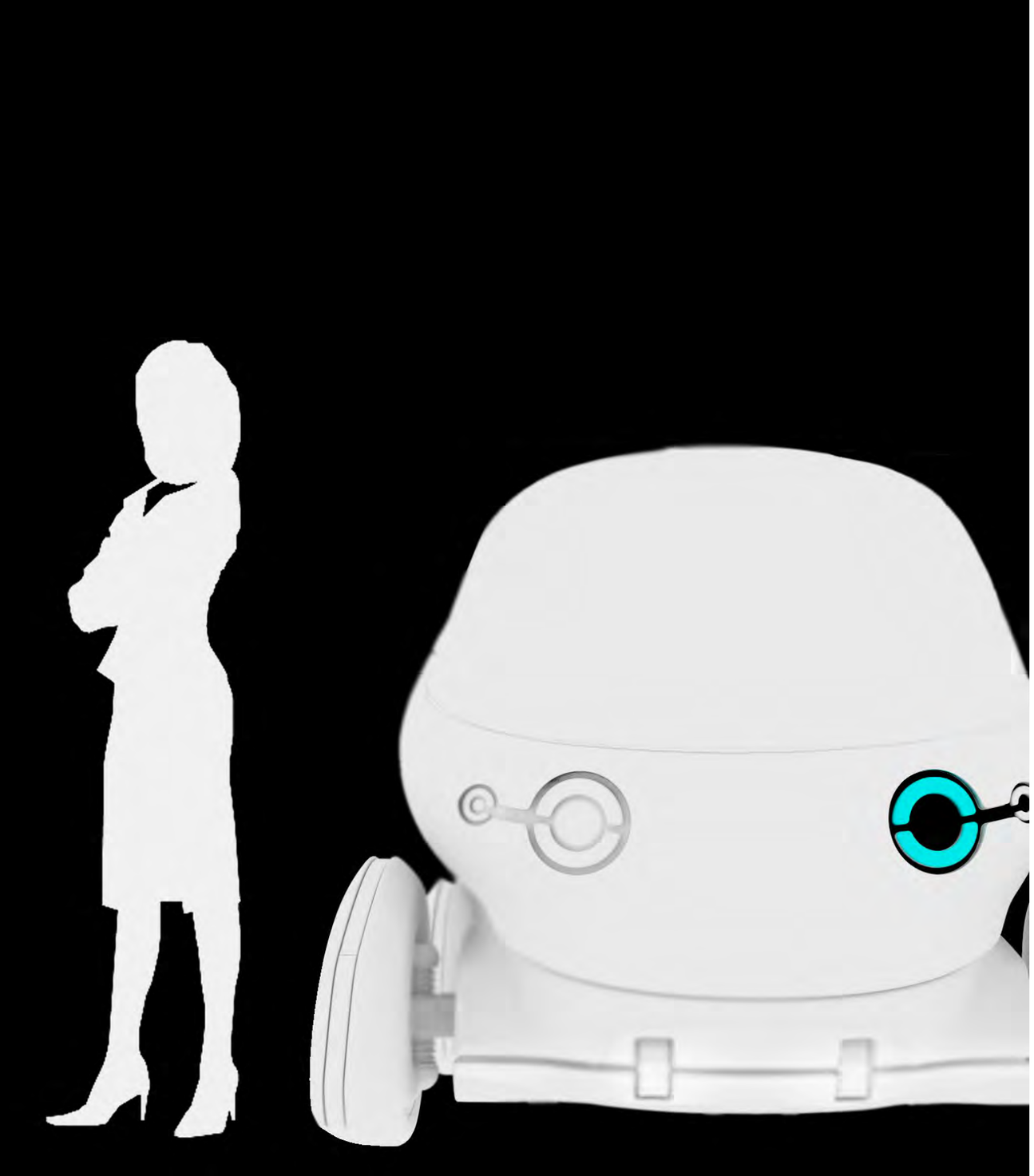

停車

Thank You

Fritz Frenkler for creative mentoring during the whole studies
Andreas Schwab for introduction, organisation and creative advice
Michaela Weiß for editing render staffage
Marion Arnemann for editing render staffage
Winnie Wong for photgraphy assistance
Hasenauer & Hesser GmbH for supporting, model building and advice
Buchbinderei Konrad for binding this hardcover book
All Singapore delivery services
Our Parents

Photography was shot with Leica M8, Canon EOS 500d and iPhone4

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